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Journal of Electricity

Devoted to the Economic Production and Commercial Application of Electricity
IN THE ELEVEN WESTERN STATES

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IN THE ELEVEN WESTERN STATES

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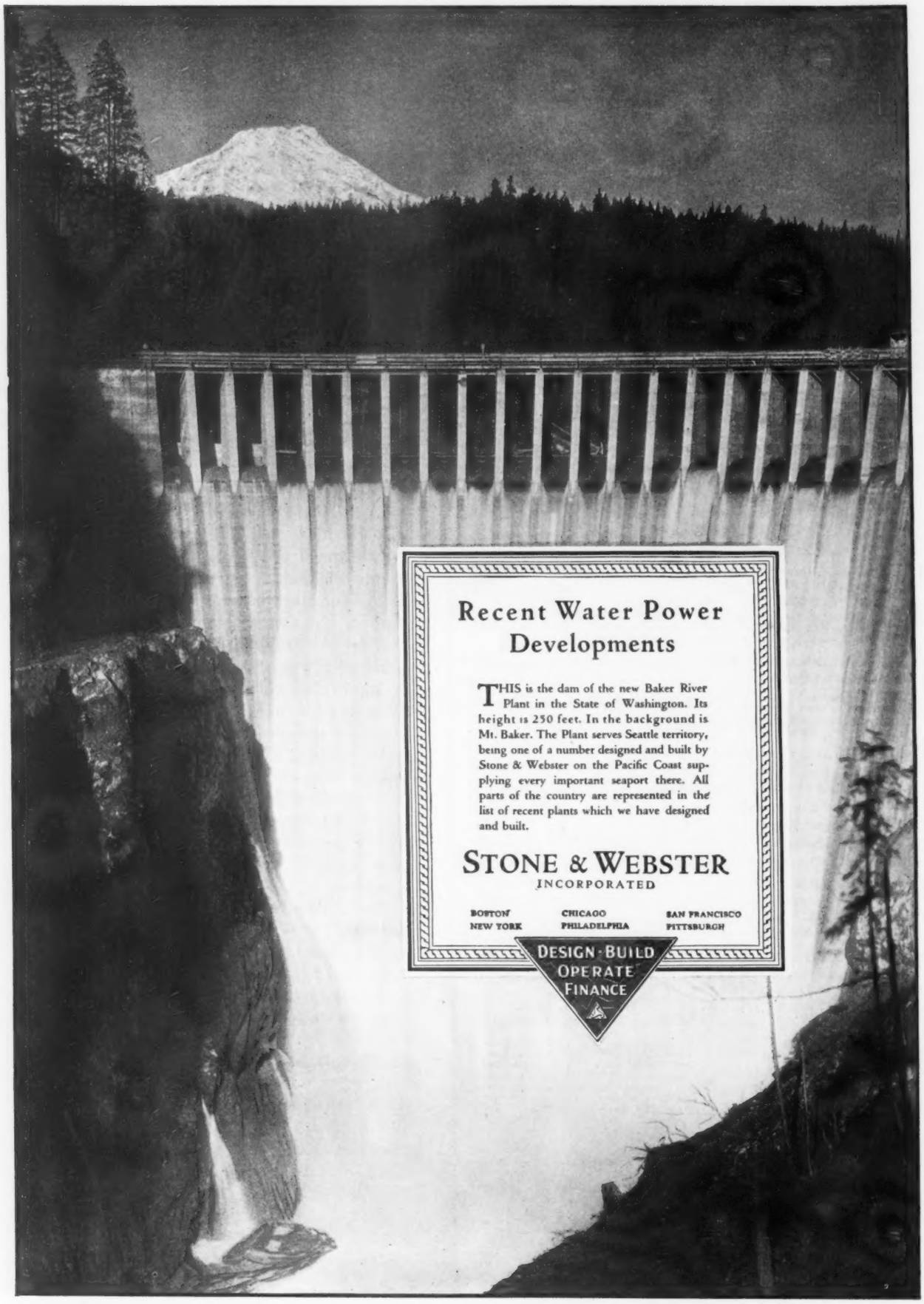
A Service to Readers and the Daily Press

ONE of the self-constituted tasks of the technical press is to record the achievements of the industry it represents not alone for the benefit of its particular readers but for the layman as well. To this end the group of McGraw-Hill publications of which the Journal of Electricity is a member has been circulating for more than two years a news service to the daily press of the country with gratifying results. Those engineers and technicians who have been prone to feel that their achievements have not been receiving the public recognition that was their due will be surprised to see the accumulation of newspaper clippings received by this company.

The following figures show how the technical press is acting as a liaison agency between the industries it represents and the daily papers:

During six months of this year the space in daily papers in this country devoted to quotations from McGraw-Hill papers totaled 2,009 columns as compared with 1,213 columns during the preceding six months period. Records indicate that quotations from the company's fifteen engineering and industrial magazines are appearing in 546 newspapers in 333 cities.

Facts like these are not known to readers, but they show that the technical papers are more than awake to their responsibilities.


Recent Water Power Developments
THIS is the dam of the new Baker River Plant in the State of Washington. Its height is 250 feet. In the background is Mt. Baker. The Plant serves Seattle territory, being one of a number designed and built by Stone & Webster on the Pacific Coast supplying every important seaport there. All parts of the country are represented in the list of recent plants which we have designed and built.
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EDITORIAL

Electrical West—Our New Name

JOURNAL OF ELECTRICITY is going to change its name. Beginning January first it will be called *Electrical West*. It will be published monthly. To an even greater degree than in the past, this paper will devote itself to telling the story of electrical development in the West, to interpreting the events of its progress and to giving guidance to its evolution.

THERE is a reason for this change of name. The title "Journal of Electricity" is too general. It does not define either the field or the purpose of this paper. It does not indicate the fact that it is a Western paper, designed for and devoted to the service of the electrical industry in the eleven far Western states. For conceivably a "Journal of Electricity" might be published anywhere, and have a national or even an international scope. The decision to call it Electrical West will make obvious the fact that it is a paper dedicated to the service of the electrical industry of the great Western empire.

MANY of the present readers of the Journal of Electricity will recall that this paper was at one time a weekly. It bore the name of Journal of Electricity, Power and Gas. Comparing that publication with the Journal as it is today, it is apparent what a great improvement was effected through the change to semi-monthly publication, making possible a larger, more studied editorial treatment and a news service with better perspective. Further experience of the last seven years has shown that a monthly publication will permit of a still broader editorial activity and will again make possible a better service to the electrical West.

ELECTRICAL men in the West are primarily interested in the three major activities of the industry—power generation, merchandising and contracting. Electrical West, as a monthly publication, will be better adapted to cover the needs of the West than a semi-monthly. It will have increasing opportunity for serving the readers in the West as their own local paper. It will enjoy broader facilities for upbuilding an intelligent appreciation among its readers of the interdependence of the four branches of the industry here in the West, and to promote the solidarity of the industry on all questions that affect its general welfare.

THE McGraw-Hill Company of California is confident that this announcement will win the instant approval of the electrical men of the West who have so loyally supported the Journal of Electricity. Electrical West, the monthly, will carry forward all the fine traditions of the Journal, with greater possibilities for useful service.

Chas. J. Hutchinson

President, McGraw-Hill Company of California.

A New Spirit in Commercial Section Activities

UNDOUBTEDLY the men who attended the recent conclave of the Commercial Section of the Pacific Coast Electrical Association—a meeting, by the way, that was the best in the history of the organization—left with a new vision of the responsibilities of the commercial departments of the central stations. If there were men at the meeting suffering from the inferiority complex that has marked most of the commercial departments of California utilities, they could not have helped but react to the inspirational messages of S. Waldo Coleman, president of the association, W. C. McMicken and R. S. Turnbull.

It is certain that the skeletons in the closet, the bugaboos and the fears regarding a frank discussion of central-station merchandising must have been thoroughly dispelled by the statements by those speakers. When one speaker pointed to the average domestic consumption of California of about 300 kw-hr. per annum as against a national average of 365 kw-hr. and a second told that companies in the Northwest are enjoying an average in excess of 600 kw-hr., it is certain that some of the men present, relatively speaking, received a kick in the shins. But the message of greatest importance brought out by the meeting was that commercial men must promote more than the bare normal growth of domestic consumption; that this growth will come only with unanimous sales practices and policies and a persistent and consistent sales effort.

The most apt description of the meeting that can be set down would be to say that it was unfortunate that every chief executive and every commercial executive with all members of his sales staff could not have been present. With the publicity that this meeting will obtain both in the press and by word of mouth it is likely that such a condition will prevail when the Commercial Section announces its next general conclave.

Concentrate the Attack in Selling

A SECOND record electric range campaign by the Puget Sound Power & Light Company, Seattle, in which 2,769 ranges were sold in sixty days, exceeding the record made this spring by 726 ranges, calls to mind an erudite thought expressed in times past by H. J. Gille, general sales manager. This thought embodies a sales policy, which has been back of that company's efforts in placing ranges among its customers in the past few years, and which, therefore, probably has been responsible in part for its success in this field. Summarized, this thought is that the sales resistances can be analyzed by careful observation and can be broken down by systematic attack.

The company found early in the game that the items of sales resistance to the purchase of ranges by its customers were three: first, that electric energy was expensive; second, that electric cooking was in the experimental stage; third, that the cost of the range and its installation were high. According to Mr. Gille, practically every form of argument advanced by a prospect as to why he should not buy consisted of one or more of these erroneous notions.

What, then, to do? Why, simply concentrate all advertising, propaganda and sales effort on dispelling these notions and let all imaginary resistances take care of themselves.

This is undoubtedly straight sales thinking. That the policy has been used, and successfully, has been borne out by results, and leads to the thought that it could be applied to selling practically any appliance, notably the refrigerator. Of course the crux of its successful application is in the accurate determination of the sales resistance, but careful observation and close study should reveal these. After they are known, shrewd planning of advertising and intensive training of salesmen should conserve a deal of effort now, perhaps, wasted. Many a general has won a battle because his accurate knowledge of the strength and disposition of the enemy's forces has permitted him to direct his attack with a minimum of guesswork and a maximum of strategy.

The Political Issue Is Only Asleep

IN Oregon the Housewives' Bill, under the more dignified official title of the "Oregon Water and Power Board Development Measure," was gently laid to rest by mourners and rejoicers in almost the exact ratio of one to four. Our stasistician, without placing anything end on end, has figured that if the proponents had mustered forty-two more yeses the measure would have been rejected by exactly four out of five voters. This ratio is reminiscent of a now well-known advertisement warning us against the ravages of pyorrhea, but the Housewives' Bill was considerably less subtle than any such insidious disease. It did not intend to creep imperceptibly into the vitals of the body politic there to strike before its dangers might be discovered. Rather did it approach like a hungry animal, whose long, sharp fangs were plainly visible to the most casual observer. Therein lay its weakness. The body politic is sometimes fooled by a wolf in sheep's clothing, but almost never by that wolf stripped of his masquerade.

However, though the measure itself lies deeply buried, its ghost still hovers about. Expression of this condition is heard occasionally in the press—in one breath rejoicing in the defeat of this pernicious measure; in the next wondering what is going to happen to "the people's white coal" and why it is allowed to run to waste; asking why rates are not as cheap in Portland as they are in Tacoma and Los Angeles; dogmatically stating that if they were as cheap industries would flock to Oregon; bewailing the state of the poor farmer, who sometimes must pay an advance earning on the unproductive portion of an extension to serve him; and raising numerous other questions which sound logical and pertinent to many an honest and intelligent voter. Many evidences there are that the essence of the Housewives' Bill will be revived in some form

less objectionable to the electorate but equally threatening to the electrical industry, and that it will be backed by abler proponents. When this is done a fairly plausible case will be made out in its favor and its defeat will be more difficult.

Although facts show and experience further has demonstrated that the arguments in favor of state ownership are fallacious, the electrical industry must not anticipate that the voter will so believe at the next election. The time to start laying the defense for future attacks is now. Let the industry redouble its public relations activities; let it anticipate the weaknesses in its opponents' contentions and begin to controvert them before they are expressed. Above all, let it be understood that the issue is not dead, but that, phoenix-like, it rises and rises and rises, as it has in California.

The first is not that of the public utilities of Oregon alone; it is the fight of the entire electrical industry in the West. Let it be recognized as such with ample preparation to meet it in the knowledge that the industry is right and that right must prevail.

Hats Off to the Lighting Committee

ACCOMPLISHMENT of work set out to be done always merits recognition and commendation. To know what objectives should be sought and intelligently to plan means of attaining those objectives is no less praiseworthy. In both respects the lighting committee of the Commercial Section, Pacific Coast Electrical Association, deserves attention.

That the leadership of this committee successively has been awarded to its present chairman, Clark Baker, would indicate that under his direction would result the accomplishment desired of this branch of Commercial Section activity.

Three years ago this same lighting committee decided that the writing of papers was all very well in its way but that literary effort alone was not succeeding in producing better lighted homes, schools, offices and factories. The need of the hour seemed to require work. Taking off its Windsor tie and laying down the pen, this committee took off its coat and vest and assailed the problem with vim and vigor.

The first year's activity saw the establishment and successful operation of two lighting schools. The actual accomplishment of work by a committee so affected the Commercial Section that it decided to continue so able a body intact. The second year the lighting committee arranged a condensed and yet complete lecture, illustrated by the use of an ingenious lighting box display, and placed this lecture before the leading business clubs of the state of California, reaching over 3,000 business men.

This year the lighting committee already has accomplished a major part of its work, while many other committees have not yet begun to organize. The first section of its work, that of carrying a review of the committee's work to the jobbing organizations and enlisting their support in follow-up sales effort, has been accomplished. The second major task, that of presenting to the State Highway Commission a complete analysis and survey of the possibilities for lighting the highways of the state at a very modest cost, is under way. The third activity, the conduct of a lighting school and lighting week in San Diego in January, wherein the results from the school will be closely studied, is well organized and ready to start.

It would seem but natural that the illumination men, the pioneers of the electrical industry in truth, should continue to lead the procession for greater electrification. Although electric light has come into general acceptance per se, the lighting men do not intend to let the matter stand there. For many years the mere fact that electric light was superior light seemed to be enough. Now the lighting committee is to lead us to the realization that not by light alone may we expect to see, but rather by light controlled, adapted, and directed so that as a crude force it will not blind its beneficiaries through the very potency of its energy misused.

Accidents vs. Production

STILL the battle of accident prevention goes on, fought vigorously in some sectors and completely overlooked in others. Some feel that accidents are predestined to occur in spite of human efforts to the contrary. Some believe that accident prevention and preventive education are nice theories but too costly. Still others are just plain procrastinators. But few have faced the cold facts and fully analzed them.

Statisticians of authority report that an average of some 2,750,000 industrial accidents occur annually, each causing the loss of more than one man-day. Considering this and considering further the retarded production, reduced efficiency, and lowered morale, is not serious effort in behalf of accident prevention well worth while?

An International Engineering Conference in Japan

POSSIBLY because engineers on the Pacific Coast are closer to Japan and more in touch with its engineering problems and achievements, the announcement that plans are under way for the holding of an international engineering conference in that country will be received with more than passing interest. According to press reports, Dr. M. Kamo, president of the Japanese Society of Mechanical Engineers, has announced that co-operation from the government of Nippon has been assured and that a great engineering conference will take place in that country in the fall of 1929. Many engineers have expressed a sentiment in favor of learning at first hand of the engineering progress and accomplishment in the Orient. This is particularly true in the West on account of the progress made in Japan in the development of hydroelectric power. At any rate, it is certain that the proposal to hold such a conference in Japan will meet with hearty support in this section of the country.

WIDE-ANGLE construction on the new 44-kv. Salida-Alamosa transmission line of the Public Service Company of Colorado. Although the surface appearance and character of the country is truly desert-like, the water table is only two feet or so beneath the surface. The 63.6-mile line was built in 82 working days.

Ryan Laboratory Opens Untouched Field of Electrical Investigation

By J. T. Lusignan, Jr.

Stanford University, Palo Alto, Calif.

IN recognition of his invaluable contributions to the advancement of electrical science the donors of the new Stanford University laboratory have named it the Harris J. Ryan laboratory. The high-potential equipment installed there opens a wide field for advanced research and undoubtedly will lead to further advances in the understanding of electrical phenomena.

THE new Harris J. Ryan High-voltage Laboratory, which was recently completed and placed in operation at Stanford University, is probably the foremost of its kind in the world in regard to size, capacity of equipment, and facilities for high-voltage research. The authorities responsible have thus thought to furnish ample means for meeting the needs of the power industry for graduate engineers well trained in high-voltage phenomena, and for assisting in the solution of problems encountered in long-distance power transmission practice. The existence of this laboratory is largely made possible through gifts from various electrical concerns, contributed principally in recognition of the work of Dr. Ryan who, with his associates in the old high-voltage laboratory, built in 1913 but since outgrown, assisted materially in the development of the insulating supports and conductors for the present high-voltage systems on the Coast up to and including the three great 220,000-volt systems.

Building

The main laboratory building is a 173 x 60-ft. steel-frame structure covered with corrugated Transite. The distance from the floor to the lower chord of the roof trusses is 55 ft. One side of the building faces the right-of-way set aside for the 1,000-kv. 3-phase transmission line. Three 40 x 50-ft. doors on that side allow proper clearances for the high-voltage leads to be brought into the building to the transformers. These doors are so well mounted that they may be moved easily by one person.

All of the inner surface of the building is painted drop black so that with all doors and ventilators closed the darkness is photographically complete. This feature facilitates the observation and photography of corona and other phenomena incident to high-voltage tests within the building and under ideal conditions.

Immediately adjacent to the main building is a smaller, 2-story concrete structure containing the power room, with its motor-generator sets and main switchboards, offices for members of the faculty, and rooms for instruments, equipment, photographic work, and seminar classes.

The main transformer set of the laboratory was designed by A .B. Hendricks, Jr., of the General Electric Company and built at the Pittsfield works of that company. The bank consists of six units arranged for "chain" connection and has a normal single-phase rating of 2,100 kv., the highest yet attained at a commercial frequency.

Each transformer unit has a normal rating of 350 kva., 2.3/350-kv. They all are of the familiar shell type with the primary and secondary windings on the center leg. All but two of the transformers, which commonly are called the "line" units, are equipped with a third winding called the exciting winding. This third winding in reality is part of the high-voltage secondary winding and furnishes the excitation for the next higher transformer in the chain connection. Windings themselves are of the concentric type and fit compactly around the core leg. The primary winding is innermost, the exciting winding next and the high-voltage on the outside.

The lower end of the 350-kv. winding is grounded to the transformer core and tank. A film cut-out is placed in that end to provide for the insertion of an ammeter to read the current in the high-voltage winding. The upper end of this winding is connected to the cap on the high-voltage terminal and to one end of the 2.3-kv. exciting winding. The other end of the exciting winding is brought up through the center of the high-voltage terminal, insulated from the latter for 2.3-kv. by means of a small Herkolite tube. (See Fig. 1.)

Split Primary

Unique among the features of these transformers is the manner in which the windings have been arranged to secure low leakage reactance and yet ample insulation between them. The 2.3-kv. primary winding of each unit is in two parallel sections, one above the other on the core. The lower half supplies the kva. for the lower end of the high-voltage winding while the upper one is wound to supply the kva. for both the upper end of the high-voltage winding and all of the exciting winding. The exciting winding occupies only the upper half of the core and is very closely coupled with the primary turns from which it receives its excitation. Thus the leakage reactance between them is very small. The advantage of this is readily apparent when the

exciting windings are connected in for chain connection because thereby the reactance of the set is kept down to a reasonable figure, eliminating the bad features of a large shift in phase angle and instability of voltage control. This desirable condition usually was difficult to obtain in former high-voltage set-ups using several units.

Impedance of the transformer set is made up almost entirely of reactance and measures as follows: one unit only, 3.8 per cent; two units "chain connected", 6.9 per cent; three units "chain connected", 12.4 per cent.

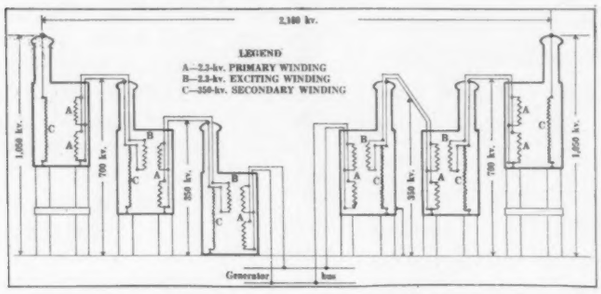


Fig. 1. Schematic diagram explaining chain connection whereby more than two million volts is obtained between terminals.

Fig. 1 shows a diagram of the six transformers connected in "chain" for obtaining 2,100 kv., single-phase between line terminals, and 1,050 kv. to ground. As may be seen from the diagram the set consists essentially of two separate halves or legs each with its ground, middle, and line transformer units. The primary leads of the two ground units are connected to the same generator busbars, but with one pair of leads reversed with respect to the other thereby giving double leg voltage between the two line terminals.

As shown in Fig. 1 the tank of the first unit is at ground potential, but the high-voltage terminal of that unit connects to the tank of the next or middle unit. Thus the latter must be insulated from ground for 350 kv. This is done by means of a set of three Herkolite cylinders 3 ft. in diameter, 5 ft. high and with walls ¾ in. thick. From crushing tests made on other cylinders of the same material, it is estimated that the factor of safety is over 100/1, which is ready assurance against any danger from vertical mechanical forces. The top or line transformer-unit tanks require an insulation from ground of 700 kv., hence two sets of these cylinders are used supporting the tanks about 10 ft. above the floor. A triangular wooden framework of maple 5 in. thick separates these two sets of cylinders. Thin felt rings are used at both ends of each cylinder to protect the edges of the cylinder walls and to aid in distributing the weight. The weight of each transformer complete is 22 tons.

Each transformer is equipped with a voltmeter coil. This consists of a few turns placed near the lower end of the core so as to link with the same flux as the average turn of the high-voltage winding. Thus a direct indication of great accuracy may be obtained regardless of load or power factor. Principle errors that could arise there would be due to the resistance of the high-voltage winding and the voltmeter coil itself, but these are negligible. Leads are brought out to the cover of the transformer for connection to the voltmeter. Ratios provided for, between the high-voltage winding and voltmeter coil, are 500/1, and 1000/1.

Tests with a single transformer showed the error of the readings thus obtained to be only about 0.3 per cent. With three transformers in chain, however, the voltmeter coil of the ground unit does not compensate for the reactive and transient rise in voltage through the other two transformers.

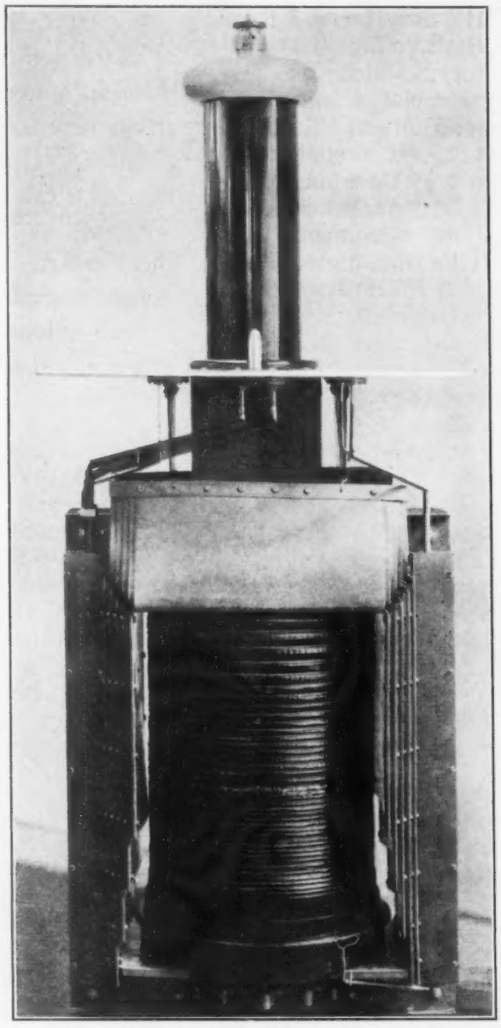


Fig. 2. View of one of the 350-kv. transformers untanked and showing construction details.

Hence a voltmeter on the ground unit reads low. The magnitude of this error as determined by numerous tests varies according to the nature of the load and connecting leads. This has been shown to be largely attributable to high-frequency disturbances set up by brush discharges and the like which appear at such high voltages. In factory tests with non-inductive resistance loads these high-frequency disturbances have been largely damped out and the transient rise reduced considerably. Part of the first work planned to be done in the new laboratory is the development of a 1,000-kv. water-column resistance that will serve as a non-inductive high-voltage load and in addition serve as a potentio-

meter for checking calibrations of needle gaps and sphere gaps at high voltages.

No-load loss for a single transformer at normal voltage is 20.8 kw., the exciting current being 10.8 per cent. Open-circuit measurements show that

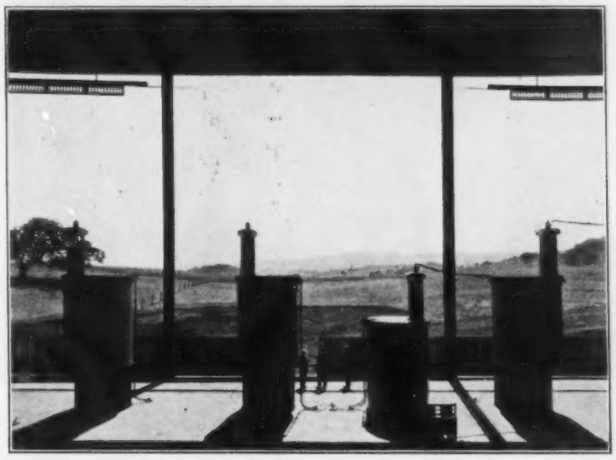


Fig. 3. View from the operating platform looking through the three 40-ft. doorways out upon the right-of-way for future experimental transmission lines. This view shows only the four center transformers and the needle-gap overhead. It may be noted that only one of the center transformers is mounted on the floor. This is because one of these center units is used as a line unit for the 3-phase connection shown in Fig. 5. Thus it must be insulated for 350 kv. from ground.

the current is leading under all no-load conditions. The power factor as read at the ground unit is 0.663 for one transformer, 0.573 for two "chain connected," and 0.435 for three. No-load loss for three units at normal voltage "chain connected" is 50 kw.

On the line terminals of the set, each rated at 1,050 kv. above ground, are choke coils made up of reactance turns and carborundum resistance rods in parallel. These are to help check voltage surges and to damp out high-frequency oscillations. To shield the outer rims of these and reduce the brush discharge therefrom a spun aluminum torus was fitted around each coil. The outside diameter of the torus is 6 ft., while the radius of curvature of its edge is 6 in.

Power Equipment

Two motor-generator sets supply power for laboratory purposes. The motors are of the salient-pole synchronous type, 3 phase, 6 pole, 1,200 r.p.m., 500 kva., and 4 kv. The generators are wound for both single and 3-phase operation. Their single-phase rating is 1,050 kva. Windings are capable of series and parallel connection giving either 1.15 or 2.3 kv.

The generators were specially designed for the Ryan laboratory by R. W. Wieseman of the General Electric Company and are capable of giving remarkable sine-wave generation under all conditions of load. This is a highly dseirable asset in high-voltage testing work where circuits of considerable capacitance are involved. If the voltage wave contains even small harmonics, especially tooth ripples, the capacitance of the circuit will amplify these greatly and cause a sawtooth instead of a smooth current wave.

These sine-wave generators have cylindrical rotors with large uniform air gaps. The field coils are arranged to give a sine-wave flux distribution, while the pitch and distribution of the armature coils are such that harmonics in them are reduced to practically zero. A heavy distributed damper

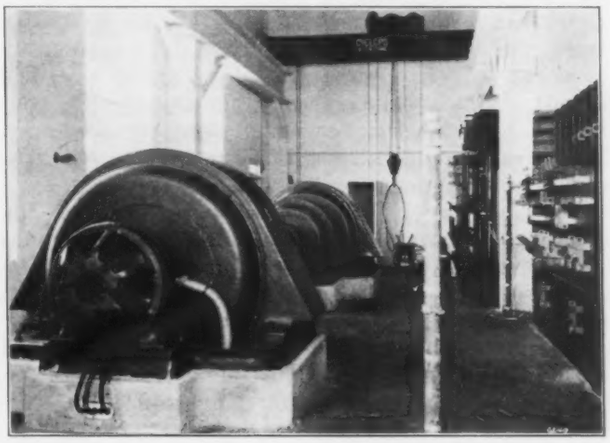


Fig. 4. Power room at new Stanford laboratory showing the two motor-generator sets and the control panels.

winding is placed around the rotor over the pole faces to eliminate the double-frequency armature reaction of the single-phase armature currents and thus prevent the induction of triple-frequency voltages back into the armature winding.

Factory tests were made on the generators under all conditions of load varying from no-load to direct short circuit, and included one load of pure capacitance. Oscillograms of voltage and current obtaned

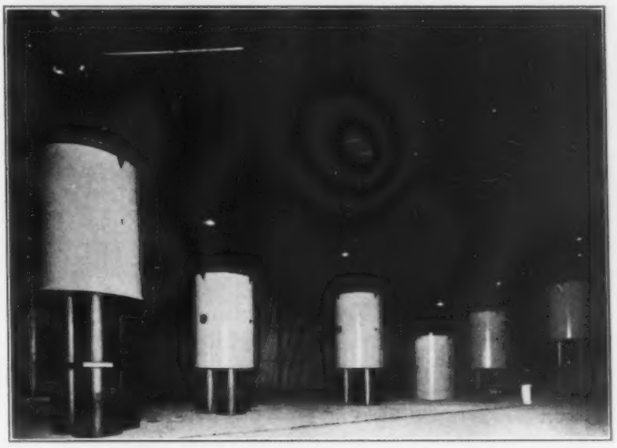


Fig. 5. Flashlight view of interior of laboratory showing all six units of the transformer bank. In the right foreground may be seen the switch panel controlling all transformer primary leads.

through these tests showed waves of practically perfect sine nature in all cases. These results are deeply gratifying in that they are at once a ready assurance that all tests with the transformer set can be made starting with a voltage of standard wave form on the generator busbars. This feature is a long step toward consistent and reliable test results.

Direct-connected exciters on each end of each shaft furnish separate field excitation for each

motor and each generator. Motor-driven rheostats in the exciter armature circuits provide comparatively close regulation. The fine degree of voltage regulation desired and necessary in the sine-wave generators is provided by an additional motor-driven rheostat in the field of each exciter supplying a generator field. These rheostats are all controlled from the main board by means of push-button switches. A hand-operated rheostat in the field circuit of each exciter supplying the synchronous motors provides the necessary close control there. This arrangement facilitates a smooth and sensitive regulation of generator voltages.

Switches for changing the connections of the generator windings and for paralleling the machines themselves are located in the power room. From the generator buses underground cables connect with a small selector switchboard on the floor in the center of the main laboratory. All the transformer leads are brought through conduit under the floor to that switchboard. From that point therefore, connections for obtaining the various transformer arrangements can be made. (See Fig. 5.)

The principal arrangements which may be obtained with the set of six units are as follows:

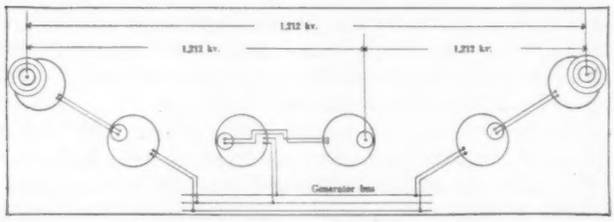


Fig. 6. Schematic diagram showing 3-phase connections. From this it will be apparent why it was necessary to insulate one, and only one, of the center transformers from the floor.

potentials to ground, 350 kv., 700 kv., and 1,050 kv.; potentials between lines, single-phase, 700 kv., 1,400 kv., and 2,100 kv.; potentials between lines, 3-phase, 606 kv., and 1,212 kv. With any of these different arrangements the full rated capacity of the set, i.e., 2,100 kva., can be obtained by proper paralleling of the transformer units and the generators.

Near the center of the building and facing the transformer set is the control platform upon which are the two control tables, one for each motor-generator set. On these are located the connections for the portable instruments and the push-button switches for controlling generator voltage and the main and generator field circuit breakers. Above the control platform and extending along one side and the end of the building is an observation gallery. In addition there is an overhead walk on the lower chords of the roof trusses extending the entire length of the building beneath the roof peak, for making observations from above.

The main 6-unit transformer set occupies the major part of the floor space, or about 120 x 60 ft. The remainder of the building is set aside for the equipment formerly in the old high-voltage laboratory but now to be used for elementary instruction and for research at lower voltages. Everywhere about the line terminals of the main transformer set and all attachments to them, 20-ft. clearances have been provided to prevent possible arcovers and to maintain stable high voltage conditions as well

Fig. 7. Showing some of the physical arrangements of the building and its contents. The operating gallery may be noted in the background at the right. Above the operating gallery may be seen the visitors' observation gallery.

as to lessen danger to life and equipment. (See Fig. 7.)

About 200 acres in all were set aside by the university for the use of the laboratory. This includes a right-of-way 300 ft. wide extending from the laboratory for a mile and a half with provision for prolonging it further for a distance of seven miles. Along both sides of this right-of-way are to be erected towers for the experimental 3-phase line with cables stretched between. The high voltage lines are to be suspended from these transverse messenger cables, allowing conductors to be arranged at any desired spacing, height, or configuration.

New Research Work

Extensive tests of corona loss are to be made on numerous conductor and insulator specimens up to a million volts, 3-phase. In relation thereto will be the further development of the high-voltage wattmeter for the measurement of these losses directly at the line. Work on such a wattmeter by faculty men and graduate students has been progressing for the last three years, the last stage reached having taken it up to the limit of voltage capacity

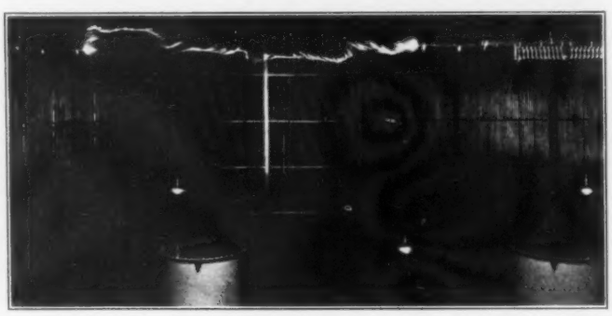


Fig. 8. Discharge of more than two million volts across a needle-gap 20 ft. in length.

of the old laboratory. Its extension with the higher voltages of the new laboratory is part of the work planned for the ensuing year.

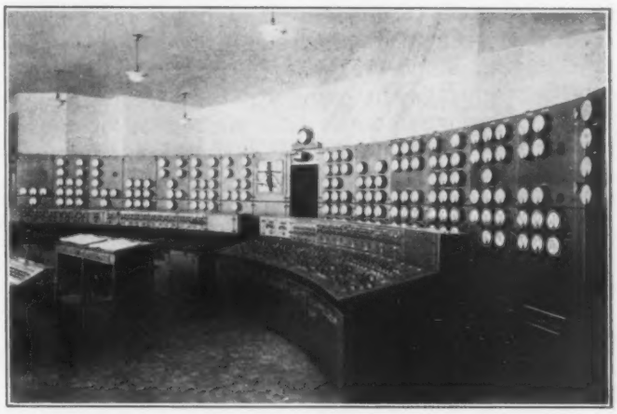
Facilities of the laboratory will permit of the study of "space charges" about conductors and insulators in the regions of potentials greater than heretofore available. The problem of determining the factors contributing to subnormal flashover insulators now can be attacked with greater thoroughness and confidence. Plans are under way toward the evolution of a high-voltage impulse generator which will permit the investigation of problems relating to lightning protection of property, lightning flashovers of insulators, and all conditions involving transients of steep wave fronts.

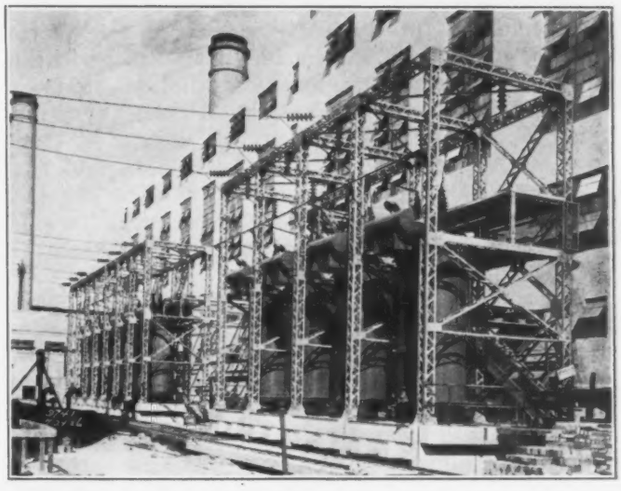
With the large space available inside of the laboratory alongside of the main transformer set conditions are ideal for making high-voltage tests on the active part of full-size towers and switch structures, using the advantages furnished by the lightproof feature of the building. As a further utilization of this space field tests are planned in the calibration of measuring gaps in the region above one million volts, about which so little is definitely known. In tests and demonstrations on the set at the factory and in the laboratory a point gap of 20-ft. spacing was arced over 50 or more times, so that there is every assurance that the equipment is capable of creating a sufficiently high potential. If it is assumed that the rule of 10 kv. per in. for breakdown of air between points still holds at this large spacing of 20 ft. then the arcover voltage mentioned was in the neighborhood of 2,400 kv. In any event it indicates that a voltage well over the normal 2,100-kv. rating of the set was reached.

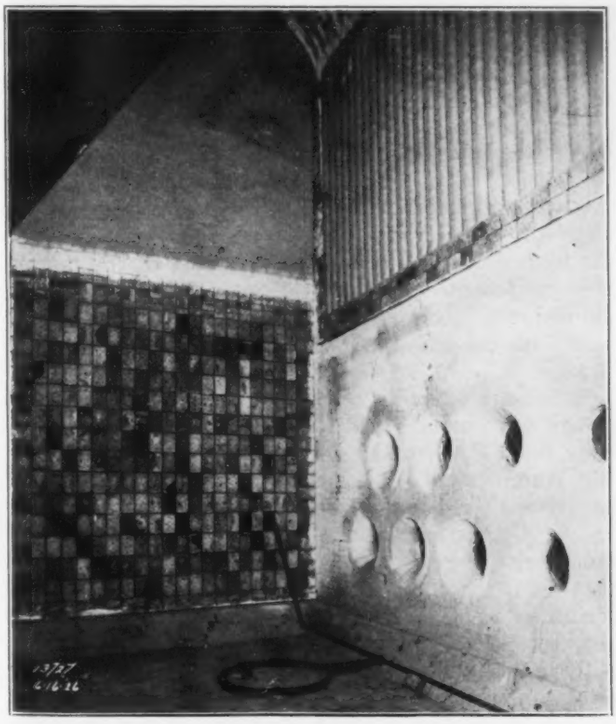
Dr. Ryan has been relieved of the major part of his duties in the undergraduate division of his department in order that he may give the greater part of his attention to the work of the graduate department, and to the furtherance of studies in high voltage. The operations in the new laboratory will be in charge of Prof. J. S. Carroll, assistant director of the laboratory, and will be carried on largely by graduate students.

It is hoped that the laboratory will contribute much to the electrical art and thereby justify the faith which the patron companies and the university have placed in it when they made its existence a reality. It surely should serve to assist the power companies materially in the solution of problems incident to present high-voltage lines, and thereby place transmission of large blocks of power on a still more economical and reliable basis. What effect it will have in fostering any movement toward the use of higher line voltages than the limit now reached, 220 kv., is problematical.

THREE late views of the Long Beach steam plant of the Southern California Edison Company. At the right above: main switchboard which is located in the switch house remote from plant noise. At the right below: outdoor transformer rack, the 60,000-kva., 11/70-kv. bank for the last 55,556-kva. unit installed appears at the right. Immediately below: interior of one of the new furnaces showing the water-cooled side walls and the water-cooled front wall above the burners.







Combination Domestic Schedule Including Use of a Load-Limiting Device

By M. W. Phillips

Manager, Ojai Power Company, Ojai, Calif.

FACED with the necessity of building up winter load to offset a summer irrigation peak, this company has developed a large amount of residential heating load by means of a successful combination domestic rate schedule which incorporates the use of a load-limiting device for the purpose of limiting the customer's demand and at the same time reducing his minimum charge.

BEFORE considering the new domestic cooking and heating rate which has been developed by the Ojai Power Company, it will be necessary to thoroughly understand the condition affecting the load carried and the service rendered by this utility because there are so many local factors that might influence the determination of a rate for this type of service.

The Ojai Valley is a small valley or "nest" in the mountains fifteen miles inland from Ventura, Calif., about twelve miles long and ranging from one to five miles in width. The climate is delightful, the valley being far enough from the ocean to be almost entirely free from fog and having sufficient heat in intervals of short duration during the summer to develop a fine grade of oranges on the east end offset by occasional frost in the west end during the winter to give the invigorating winter climate so much desided by tourists. The principal sources of revenue from which the inhabitants derive their livlihood are tourists, wealthy winter residents and the production of fruits, chiefly oranges.

The leading men of the community tried for several years to induce outside interests to serve the valley with electricity, but were unsuccessful and finally organized the Ojai Power Company with the idea of serving the district with electricity and water for domestic use. The growth of the region was rapid and in the early stages of the World War arrangements were made with the Southern California Edison Company for wholesale service over a 15-kv. line from Ventura. Practically every irrigation plant in the valley was converted from gas-engine to electric drive within a period of two years and this load has increased until at the end of four years approximately 1,200 hp. in motor load has been secured, 95 per cent of which is used for irrigation.

The condition then presented itself of an overloaded distribution system that demanded reconstruction with materially increased capacity for handling a strictly seasonal load and nothing but an insignificant amount of lighting load in the winter time. Because irrigation rates themselves would not provide sufficient revenue to justify the investment in plant equipment, the necessity of securing additional load with opposite peak characteristics of irrigation became immediate. A combination domestic rate was in effect and the company was securing a number of customers with ranges and water heaters on this rate which materially helped, but it was impossible to acquire any large volume of domestic heating load on account of the minimum charge based on the connected load.

The writer studied this problem for two years in an endeavor to find a solution that would prove sufficiently attractive to the eastern people who have winter homes in the valley to warrant them installing electric heating equipment. Tests were made and records kept with demand meters and curve tracers. It was found that the demand never exceeded 50 per cent and averaged between 30 and 40 per cent of the connected load for residences, the lower percentage obtaining where the ratio of air heating to other connected load was high. This led to the conclusion that a minimum charge on the connected load basis was unfair and unjust to the consumer in its application to service of this character and only served to defeat the object sought.

Demand meters were thought of and tried but there was always the possibility of the thoughtless connection of a greater load than necessary with the attendant complaint and ill will of the consumer over an excessive minimum charge by reason of the high demand. Also the extra cost of the metering equipment was a factor and the fact still remained that there must be service equipment of sufficient capacity to take care of the maximum demand.

After considerable correspondence with engineers of the California State Railroad Commission and a visit from C. Grunsky for the purpose of satisying the commission that special consideration should be given to this case, the suggestion was made by A. V. Guillou, engineer of the gas and electric division of the commission, that a load-limiting device which could be set to trip at some predetermined amount be applied. The device was to be set at a point equivalent to the amount of load for which the consumer applied and on which the minimum charge was based.

This suggestion was adopted and for an installa-

tion rated at 75 amp. or less a standard 75-amp. contactor with a thermal overload relay is used. This equipment is similar to a motor starting switch with connections reversed so the load comes through the overload relay first. Because lighting is not

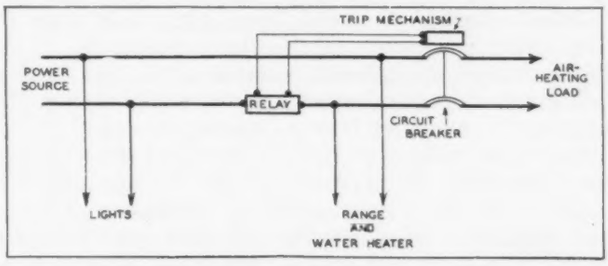


Fig. 1. Schematic wiring diagram showing location with reference to lighting, cooking and heating circuits of load-limiting equipment for installation rated at 75 amp.

a factor considered in the demand charge, the lighting circuits are connected ahead of the overload equipment. While ranges and water heaters are considered in the demand and must be fed through the overload equipment, it might prove inconvenient or annoying to have them disconnected at some inopportune time so they are connected between the overload relay and the contactor. The remainder of the heating load is connected on the load side of the contactor and is subject to disconnection when the total load exceeds the amount contracted for by the consumer. (See Fig. 1.)

For loads of greater magnitude, plain magnetic contactors of suitable capacity are used, The control circuit is actuated through the closed contacts of an over-current relay, the coil of which is energized by the secondary circuit of a three-wire current transformer and in series with which is also the current coil of a 5-amp., 220-volt meter. (See Fig. 2.) Installations of over 30 kw. limit ratings

Table I.—Monthly kw-hr. Consumption and Billing for a Six-room House with 29-kw. Connected Load and 15-kw. Load-Limiting Device.

Month.	Kw-hr. Consumed	Total Bill
November 1925	846	$ 21.82
December	1,069	26.28
January, 1926	926	24.42
February	1,134	27.58
March	570	16.30
April	544	15.78
May	463	14.16
June	267	10.24
July	115	5.85
August	171	7.53
September	278	*10.46
October	320	11.30
Total	6,703	$191.72

Yearly minimum	$114.00
Option of 7 months heating on connected load basis, minimum would be	190.73
Actual yearly bill would be	212.63

are usually three-phase and two over-current relays are required.

This service may be contracted for over a period of six or seven months during the winter season and then the minimum may be reduced during the summer to the demands of the cooking and water heating where means are provided for the company to seal the heating circuits in an open condition. If this service is contracted for on a yearly basis the minimum will be made cumulative annually

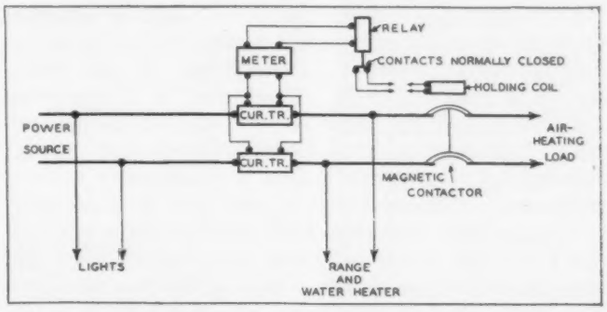


Fig. 2. Schematic wiring diagram showing location in line with reference to lighting, cooking and heating circuits for installation exceeding 75 amp. rating.

Table II.—Rate Schedule for Combination Domestic Service Including Provision for Load-Limiting Device.

OJAI POWER COMPANY — Revised Sheet CRC No. 79E
OJAI, CALIF. — Concelling Sheet No. 74E

SCHEDULE C-2

(Cancelling schedules C, D, E, F and H)

COMBINATION DOMESTIC SERVICE

Applicable to combination lighting, heating, cooking and small power service.

RATE.

First*	30 kw-hr. per meter per month	11.0 per kw-hr.
Next	220 kw-hr. per meter per month	3.0 per kw-hr.
All over	250 kw-hr. per meter per month	2.0 per kw-hr.

* For residences, flats or apartments of more than seven rooms add 5 kw-hr. per additional room to the first block.

Minimum Charge.

First 7 kw-hr. or less of connected capacity exclusive of lighting and lamp socket devices ..... $3.50 per month

Over 7 kw. of connected capacity exclusive of lighting and lamp socket devices ..... .75 per month

SPECIAL CONDITIONS.

(a) Service will nominally be 110/220 volts three-wire, single-phase alternating current.

(b) This rate applies only where a domestic consumer installs and uses appliances other than lamp socket devices of at least 2-kw. capacity for residences, flats or apartments of 8 rooms or less and 5-kw. for residences, flats and apartments of 9 rooms or more.

(c) Bath room, halls and cellars are not classified as rooms.

(d) Connected load will be taken at the name plate rating of all heating and cooking apparatus permanently installed and which may be connected at any one time computed to the nearest one-tenth of a kilowatt, or at the consumer's request and at his expense, a suitable load-limiting device may be installed by the company, which automatically prevents use of connected capacity in excess of a predetermined amount.

(e) Single phase motors aggregating 5 hp. or less may be combined with cooking and heating under this schedule, in which case each horsepower of connected load shall be equivalent to one kilowatt of connected load in determining the minimum charge.

(f) When consumer installs air or radiant heating equipment of at least 3-kw. total capacity, the minimum will be made cumulative for the year.

Filed by

Issued	M. W. Phillips	Effecitve
October 12, 1925	Manager	December 1, 1925

similar to the various seasonal schedules in force by most companies for agricultural purposes. The company believes this to be fair and just as the load is more definitely seasonal than irrigation, which may overlap seriously its seasonal characteristics during a winter of less than normal rainfall.

To demonstrate the results of such a schedule upon an average consumer, figures covering a period of twelve months in the home of the writer are shown in Table I. The home is a six-room bungalow in which there is no means of using anything but electricity for light, heat and power. The dining and living rooms are adjacent with a permanent opening between and are heated with stationary floor heaters with thermostatic control. The bath room has an inset wall heater and the remainder of the house is heated by 2 and 3-kw. portable heaters. The total connected load is 29 kw. and the load-limiting equipment is set to operate at 15 kw. So far the installation has shown maximum convenience, comfort, satsifaction and economy. The cost of operation of this equipment as shown in Tble I is based upon the rate schedule reprinted in Table II.

While the seasonal characteristics and optional features may not appeal to other light and power companies enjoying a good load curve during the winter months, it would seem that this plan of limiting the demand and thereby reducing the minimum charge would be of material advantage to any company at all interested in residential heating. In the case of the Ojai Power Company the results obtained from this type of schedule have been highly satisfactory. An increase of 20 per cent in the number of combination lighting, cooking and heating consumers to which the schedule applies shows a 100 per cent increase in connected load, and a 48.4 per cent increase in gross revenue. Although the increase in demand is comparatively small, it made very little difference as the winter demand at the present time is only 50 per cent of the summer demand caused by irrigation.

Uniforms Adopted for Meter Readers and Service Men

FOR the purpose of establishing suitable credentials for its service men, and at the same time to tone up the appearance of these men, the Pacific Power & Light Company, Portland, recently has put into effect a rule requiring all men whose work takes them to customers' premises for any purpose to wear a uniform. This uniform consists of sack coat, breeches, puttees or high boots, and a cap of the outing or golf type. The coat and breeches are of olive whipcord, and the puttees are tan or black. On the breast pocket of the coat the initials of the company are embroidered in white letters on a black strip of cloth. A flap, which is tucked into the pocket during working hours, may be brought out and buttoned over the top of the pocket covering the company initials during times when the men are not on duty, so that the suit may be worn as an ordinary outing suit without taking on the appearance of a uniform when off duty.

All meter readers and men doing service work on customers' premises are required to buy and wear these uniforms. Measurements are taken in accordance with certain tailoring standards, and the suits are all purchased from one tailor, so that a more economical price can be procured. The men are then given $5 per month extra on their salaries to help them to purchase the suits and to keep the suits clean.

In some districts the company had experienced difficulty on account of appliance salesmen and others representing themselves as company men to gain access to customers' homes, so that the need of a positive identification was felt. Furthermore the company felt that its customers were entitled to have their service performed by clean and neat appearing men. The donning of the uniform has resulted in raising the morale of the men and in causing them to take greater interest and pride in their personal appearance. The action of the customers to the innovation has been reported as favorable.

All employees connected with the Pacific Power & Light Company whose work takes them onto the premises of customers are required to wear a standard uniform such as that shown on the men in the accompanying photograph. This group includes meter readers and service men. The uniform consists of olive whipcord jacket and breeches with black or tan puttees or high boots. On the breast pocket of the coat are the initials of the company embroidered in white to serve as credentials for the men. A flap covers the initials at times when the men are off duty.

Is the Customer Always Right?

By J. R. Wilson

Quality Electric Works, Los Angeles, Calif.

IN these days of high pressure salesmanship and questionable competition a contractor has a difficult job in selling service as against low price. A satisfied customer is the best advertisement any firm can have, but sometimes it costs more to satisfy a customer than his trade is worth. On the other hand a dissatisfied customer can do a contractor more harm sometimes than may appear possible to one who has not had personal experience in the matter. In no other line of construction does the contractor have to contend with as many difficulties in satisfying a customer as does the man engaged in the electrical business. The causes which create this condition are not hard to find. Most of these causes are bebond the control of the contractor and are due to fundamentals which pertain particularly to the science of electricity alone.

"Business is sensitive,
It comes only where it is invited
And stays only where it is well treated."

There are, however, some causes for which the contractor may be responsible, and which generally are inexcusable. To be in a position to answer the question which heads this article it is necessary to array the evidence on both sides of the case.

Customer Ignorance

The greatest obstacle an electrical contractor has to contend with is the customer's natural and excusable ignorance of the laws of electricity. These laws pertaining to life and fire hazards are only remotely understood by the majority of the users of electricity. It is a source of satisfaction to say that this ignorance gradually is being dispelled through the efforts of the inspection departments and newspaper campaigns being conducted by the public service corporations.

It is easy to contend that the satisfaction of low price can never equal the bitterness of the customer's eventual realization of inferior quality. But when you are trying to sell him superior quality against low price, immediately you are confronted with this same ignorance pertaining to electrical fittings and devices. Due to this ignorance most users of electricity seem to think that if their motors run when a switch is closed, or the light burns when the socket key is turned they have first class installations.

In selling a man a suit of clothes you can talk in a language he understands, but in comparing the merits of two motors or other items of electrical merchandise usually you are "talking over his head." And yet quality should be the preponderant factor in the selection of electrical equipment because of the nature of the abuses to which it will be subjected.

The greatest of these abuses is neglect on the part of the customer. It is surprising the treatment a man will give a motor, which may have cost him considerable money. Usually it is located down in some dark and dirty corner on the floor or up on a rafter or platform where periodical inspection usually is wilfully neglected. And yet he expects that same motor to run along without any other attention than an occasional "dose of oil." And I say "dose of oil" intentionally —he has been told to oil his motor and, by gosh, he is going to oil it—with the usual result, oil soaked windings and wiring, and the eventual burn-out or fire and the large repair bill. Would he accord the same treatment even to an Ingersoll watch? I don't believe he would.

What is the Answer?

In the face of these conditions, with which all electrical contractors are more or less familiar, what is the panacea with which we are going to overcome our handicap of low price competition? There is only one answer to this question, and that is service; but we are immediately confronted with a man sized problem.

What is service? This word has been so abused by some contractors that a large number of prospective customers will no longer listen to any price argument whose basis is service. On the other hand it is unsafe to stress the service feature with some prospects. If they do give you the contract they literally expect you to move your stock of materials and your workmen to their place of business and give your entire attention to no other work but their particular job.

A certain amount of personal attention should be given to each customer by the contractor. This attention is automatically taken care of where the contractor is his own estimator because he comes in personal contact with the customer. Where he employs an estimator his personal contact may come through mutual friends or club and lodge activities. A great many large contracts are influenced by the good fellowship and confidence engendered through membership in luncheon or golf clubs.

All of these conditions are indications of the progress of modern business. The old axiom of "the public be damned" has given way to the modern one of "the public be served." The old-time contractor who was a pioneer in the electrical game may have been able to get away with some unethical deals owing to the ignorance of the public and lack of competition, but not so today.

No contractor today can long survive unless his business organization is so built that each unit functions to the maximum degree of efficiency. This

efficiency must be evident in all members of the contractor's staff and particularly so with those coming in direct contact with the customer.

Stumbling Blocks

So many things can influence a customer for or against a firm that a contractor must keep a constant check on his organization if he desires to enjoy continued success. Among the things which detract from the desired pleasant relations between contractor and customer and for which the contractor himself is directly responsible, the following may be cited:

1. An incompetent estimator.
2. An incompetent stock keeper.
3. Slow deliveries of materials or tools.
4. "Skinning the job."
5. Incompetent mechanics.
6. An incompetent office force.
7. Poor bookkeeping methods.

An inspection of the foregoing list will reveal that each item has a direct bearing on customer relations. The inspection will also show that every item listed is directly within the contractor's control. Some electrical contractors are classified as very poor business men. This is no disgrace if considered as a fundamental proposition. To be a successful electrical contractor, a man should as a rule have spent a number of years as a practical mechanic. No man can be expected to learn two trades or professions at one and the same time and excell in both.

But after he has become a contractor he should endeavor to improve his business education in all ways within his power. This may be accomplished by membership in his trade association, by constant study of trade journals and books, and by studying the methods of those who have made a success of their business.

No contractor should allow his estimator's work to go unchecked for any length of time. A proper system of bookkeeping and costing of jobs will reveal an incompetent estimator in very short order. Also no estimator should be kept on the payroll if he shows a lack of knowledge of the latest code requirements. It is his duty to know and use all code rules which will benefit the contractor or the customer. The present code allowances in the use of 1,000, 1,500 and 4,000-watt circuits are examples of this thought.

Then the Fun Begins

After an estimator has been successful in receiving the award of a contract the real test of efficiency within the organization begins. A chain is no stronger than its weakest link and it is the writer's opinion that aside from the labor proposition the weakest link is the stock room.

The stock room man is the most important part of a contractor's organization. The system he works by in delivery of material and tools will determine in a great measure the profit or loss on a job. He should have full charge of the trucks and should be provided with a simple perpetual inventory system to aid in keeping a check on his stock.

A competent stock-room man who can efficiently handle the delivery, charge and credit system and other details of his job is worth more than any journeyman on the pay roll. More lost labor and job delays can be traced to inefficient stock room methods than to any other item in the category of contracting.

The Labor Problem

The next item on the list is incompetent mechanics. It is safe to say that any contractor will claim he is competent to write a book on that subject alone. Most contractors have the tendency to side-step the labor issue and claim that there is no remedy. The writer does not hold with that belief although he does feel that it is not the duty of the contractor to educate mechanics at his own expense.

The labor problem presents three factors for consideration, which may be enumerated as follows:

1. Labor's duty to contractor and customer.
2. The contractor's duty to labor.
3. The customer's duty to the contractor and his labor.

Labor's duty to the contractor may be summed up in the following creed:

I will strive each day to perform a reasonable amount of work for the pay I receive. Realizing I am the representative of my employer, I will use my best efforts to do my work and to conduct myself in a manner that will satisfy the customer and reflect credit upon myself and my employer. Knowing that I am engaged in a business whose scope is becoming wider each day, I will devote a reasonable amount of my leisure time to study, by reading the latest books pertaining to the science of my craft, and by subscribing to at least one trade journal whose pages will keep me conversant with the latest devices for the use of electricity. Believing that only through honest effort and fair play can I expect steady employment and advancement, I pledge myself to safeguard the interests of my employer, and his customers, in every way within my power.

The Contractor's Duty

The contractor's duty to labor may be covered as follows:

Knowing that only as my employees believe in and respect me can I hope to receive their wholehearted support in my efforts to succeed, I pledge myself to abide by the following code of ethics in my relations with my employees:

1. I will not hold myself aloof from any employee who may wish to consult me upon matters of importance to himself or the business of the firm.

2. I will devote a part of my time to study of code requirements and the science of my craft, so that my employees may refer trade questions to me with confidence of receiving authoritative decisions.

3. While issuing reprimands where such are merited I will not fail also to give praise where and when due.

4. I will use my best efforts to so estimate my jobs and to so conduct my business that my em-

ployees will have a reasonable amount of time in which to perform the work assigned to them.

5. I know that only through the co-operation of my employees can I hope to attain the maximum of success, and realize that ideas are wasted unless given an opportunity for expression. I will hold and attend shop meetings at regular intervals where each employee will be given the opportunity to advance such ideas as may be of general interest or of particular benefit to the business. For those ideas which react to the success of the business a part of the monetary return shall be added to the regular pay of the employee responsible for such ideas.

6. My particular trade is beset with technicalities and requirements covering the safe-guarding of life and property which are mostly beyond the understanding of the customer. Knowing this ignorance creates a tendency toward fault-finding, I pledge myself not to use snap judgment against any employee whom I know to be a competent and trustworthy mechanic. If upon investigation I find that the customer is wrong in his complaint, I shall so inform him even though such course shall jeopardize my business relations with him.

7. Believing that only through confidence and fair dealing can I hope to have my organization function at its maximum efficiency, I pledge myself never knowingly to violate any code rule or use inferior materials, nor to request any of my employees so to do. Neither will I intentionally overcharge any customer on items of either materials or labor.

The Customer's Position

The customer's relations to labor should be as follows:

I believe in the honesty and efficiency of my contractor and feel he would not intentionally violate my confidence in him. I further believe he knows his business as I know mine, and that he would not knowingly employ any but competent workmen. I realize that my knowledge of electricity is limited and that I must depend upon him and his workmen to safeguard my interests regarding life and property damage which may result from faulty construction. Therefore I will not condemn his workmen on snap judgment, but will provide them an opportunity for explanation, where any reasonable doubt appears to exist.

Why an Account System

No person likes to be re-billed for items already paid for, or charged for materials or labor never received. Items 6 and 7 of the list are potential creators of this condition and may cause the loss of valued customers. The only real remedy is to adopt a simple, efficient system of accounting which will act as a constant check against mistakes of this nature.

With the excellent accounting system devised and adopted by the Association of Electragists, International, there is no excuse for any electrical contractor allowing inefficient or obsolete bookkeeping methods to exist in his organization. This system is simple and easy to understand and gives a constant set-up of all the essential details pertaining to the financial end of the business.

The estimating end of the business also can be handled with the maximum of efficiency through the adoption of the Electragist system of estimating. No estimator who is alive to the latest developments in the science of his calling should neglect to investigate this modern exposition of practicable, proved estimating methods.

In summing up our evidence in the case of customer versus contractor, we see that the jury cannot return a verdict upon the evidence as presented. It will be necessary for the customer to prove that he did make due allowance for his ignorance of electrical construction practice, also that he was in no way responsible for any of the delays that occurred.

It will be necessary for the contractor to prove this his—

1. Estimator is competent,
2. Stock room methods are correct,
3. Labor is competent and efficient,
4. Bookkeeping system is modern,
5. Office force is efficient.

Gentlemen, we rest our case.

Australia Takes Slowly to Electric Household Devices

THE Australian market for electrical household equipment has a long way to go before it reaches the point of saturation, according to a report of the electrical equipment division of the Commerce Department made public recently. With the increasing use of electricity in Australian homes, however, the possibilities of this market for the sale of American devices are very promising.

At the present time there are about a million and a half dwellings in the commonwealth and less than a third of these are equipped with electricity. Even those thus equipped have been extremely chary in the adoption of modern labor saving devices. For example, only 2 per cent of the electrically equipped houses in Australia have vacuum cleaners, only 1 per cent have electric toasters and electric kettles. The electric flat-iron is the one popular appliance among the Australian housewives, being found in three-quarters of all the houses wired for electricity. Seven per cent of the houses have electric fans and 20 per cent have electric radiators. Australian ladies, the report indicates, are not partial to the electrical curling iron and the annual sales in the entire commonwealth are less than 100.

American electrical household appliances have the largest sale in Australia, especially in such items as vacuum cleaners and radiators. British electric fans and washing machines offer strong competition to the American product, however. During the fiscal year 1924-25 the report reveals Australia's total imports of electrical household appliances were valued at 1,137,000 pounds sterling, of which United States manufactures accounted for more than 425,000 pounds.

CENTRAL STATION CONSTRUCTION OPERATION AND MAINTENANCE

Line Construction Economically Accomplished

Low Cost of $1,495 per Mile of 44-kv. Transmission Line Obtained Through Modern Production Methods

By GEORGE BRANNON, Assistant Superintendent of Distribution, Public Service Company of Colorado, Denver

Construction of 63.6 miles of 44-kv. transmission line and two substations in 82 working days, with an average of 40 and a short time maximum of 95 men on the job, has been accomplished by the Public Service Company of Colorado. Total cost of the transmission line amounted to $1,495 per mile. The substation work involved included the enlargement of the Alamosa substation and the construction of a new 1,200-kva. substation at the distributing end of the line. Forethought in the arrangement and in the application of what may be called modern production methods is credited with the success of the job.

The low labor cost of $116.48 per mile of poles set and ready for wire stringing, or $173.70 per mile of completed line, was obtained by the simple expedient of using ordinary unskilled laborers for the common jobs incident to the construction of the line. The skilled line crews were kept off of the job except for the actual stringing of the conductors.

All holes were hand-dug. Digging crews were spread out over a 2-mile length of the line. As fast as a crew finished in one location it was carried forward to the head of the line to begin another hole. All crossarms, hardware and insulators were placed in position ready to receive the line wires before the poles were raised from the ground. Poles were handled and raised by means of a boom-and-winch hoist mounted on a truck and taking its power from the engine of the truck.

While construction methods were simplified as to personnel and equipment the construction problems imposed by topographic and geologic conditions were by no means so simple. The first 42 miles of the line passed through country having underlying water strata within two feet or so of the surface of the ground. To permit holes to be dug under these conditions it was necessary to use steel barrels as cofferdams, sinking the same as the mud and water were excavated from inside. Of course the two heads of each barrel had been removed. Under some of the more trying soil conditions even this expedient failed to keep the pole hole clear, the soil being so liquid in character that it flowed up from the bottom inside of the barrel filling the same before the pole-setting crew could get on the job. This necesssitated a double excavation. To provide something of an indication of what was to be expected as the digging crew progressed across this part of the country, a test man preceded the hole-digging crews sampling the soil with a test auger. Thus fortified with advance information the foreman was able to plan his work according to the conditions to be met and to do this in advance.

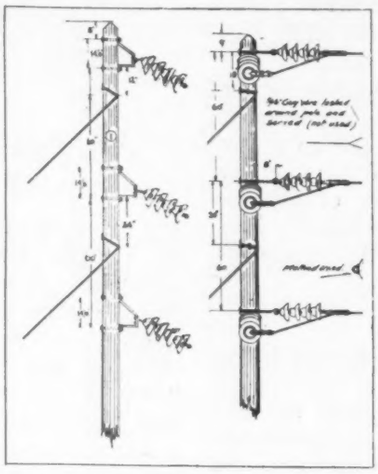


Fig. 1. Details of angle construction (left) for angles of from 105 to 165 deg., and (right) for 90-deg. angles.

The last six miles of the right-of-way traversed low mountainous country where it was necessary to blast for every pole hole. Several stretches of the line crossed ground so swampy with actual surface water that A-frame construction was resorted to in order to provide those sections of the line with sufficient transverse wind resistance.

Material and supplies were concentrated at and distributed from three main division stations. Work was carried on progressively from one end of the line to the other. The general organization of construction crews was as follows: A crew on material distribution; others on hole digging; framing and gaining; setting, lining and back filling; conductor stringing; and the final crew following up numbering and dating the poles and doing any final cleanup work necessary.

Wire stringing was accomplished with two line crews. The first crew proceeded with the distribution of the conductors from a reel cart, also removed such obstructions as fences, telephone lines, etc. This crew carried the conductors to the pole tops and in general prepared for the second crew which followed up doing the tie-in work and finishing the line. The second

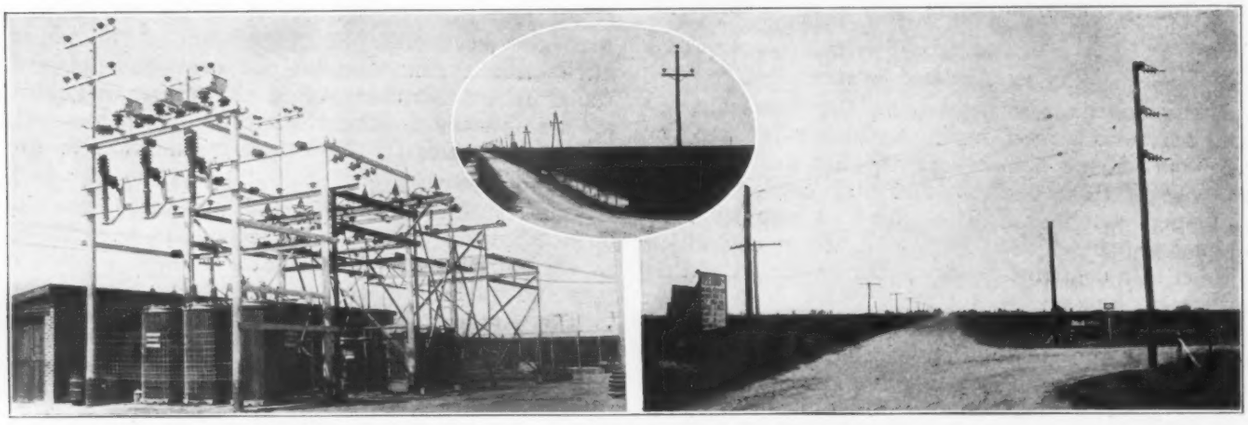
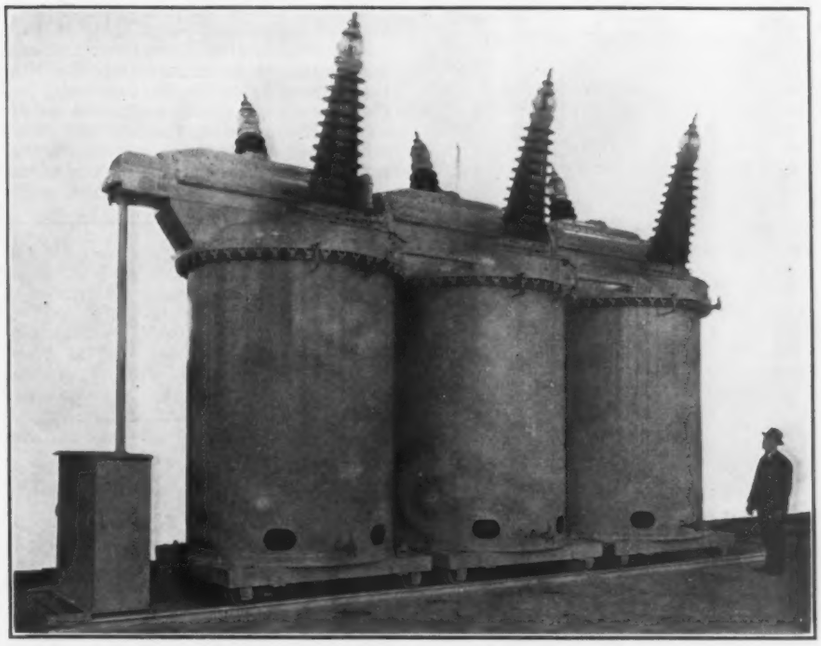


Fig. 2. Showing 44-kv. addition to Alamosa, Colo., substation of the Colorado Public Service Company (left) erected of wood poles for expediency. A typical right-angle corner is shown at the right. A-frame construction over marshy ground is shown in the insert.

crew also tightened up all bolts and other hardware that lossened due to shrinkage. Shrinkage occurred because initial erection took place when poles and in some cases crossarms were wet and somewhat green. The line was pulled to proper tension in lengths of about ¾ mile per pull. Spans used in the line varied from 350 to 1,200 ft.

Spans over 400 ft. were carried on H-frame construction. Conductors used in the line were 31/64-in. steel-reinforced aluminum cable. Pin-type insulators were used throughout except at angle positions and for certain long spans where suspension units were required. The number of linemen used for wire stringing averaged seven, with a short time peak of twelve, together with one foreman and using one two-ton line truck.

The reason for the sudden construction of this transmission line was the resumed activity in the Bonanza region of southern Colorado due to the proposed adoption of a cheaper ore reduction process. Mining optimists expect this new process to enable the operation of mines that have been closed for several years. At any rate the activity imposed upon the Public Service Company a sudden demand for 1,000 hp. of electrical energy or its equivalent and specifications called for this power to be available at a very early date. The Bonanza region formerly was served by a 16.5-kv. line from Salida, but the new requirements necessitated the construction of the above described 44-kv. line from Alamosa as the logical and economical step in supplying increased power to the Bonanza district. The history of the development of that part of the state of Colorado and the future possibilities of development of loads of various characters were considered before it was decided finally to construct the line as described.



The truck-mounting of oil circuit breakers by no means is limited to those of small sizes as the above 154-kv., 400-amp., G.E. breaker on the Tallahassee Power Company's system demonstrates. The tanks are 84 in. in diameter, the height to the tops of the bushings is 17 ft. and the weight per unit 17,000 lb.

Simple Selective Indication for Grounded Feeders

By L. F. HUNT, Development Engineer, Southern California Edison Company, Los Angeles

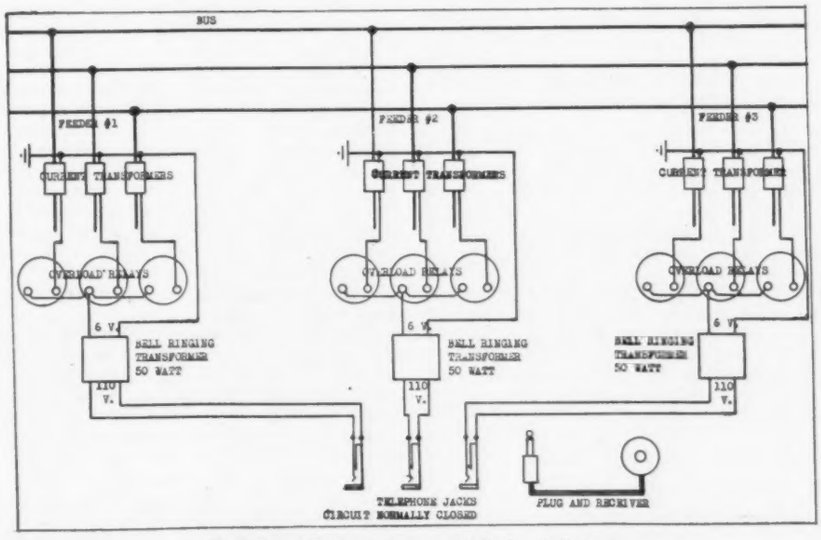
Distribution voltages in many substations range from 6.6 to 16.5 kv. and are supplied in most cases from the delta-connected secondary of a transformer bank. Conditions of ground faults on any of the lines radiating from a station bus may be indicated on the ground detector (see article on ground detectors by author in Journal of Electricity, April 1, 1926, p. 262, and April 15, p. 298.) Usually the feeder in trouble can be located only by dropping feeders one after the other from the bus until, when the feeder in trouble is dropped, the detector will indicate clear. The indicator system herein described permits the operator to investigate the location of a ground fault, when one shows up, without interruption to service.

Where three current transformers are installed on the circuit for relays this simple means of audible signal may be arranged by connecting the 6-volt winding of a 50-watt bell-ringing transformer in the neutral return of the current transformers. The 110-volt winding then is connected to a single-circuit jack as indicated in the accompanying illustration. This jack, contacts normally closed, is placed in a suitable and accessible position for the convenience of the station operator.

When a ground occurs, as indicated by the ground detector, the circuit in trouble may be located by plugging the telephone receiver from jack to jack until a sound is found. This sound is caused by the ground current which sets up a pronounced third marmonic current. This condition exists only on the particular feeder in trouble and thus as soon as the sound is located with the receiver, by shifting it from jack to jack on the different circuits, the feeder is definitely designated and may be treated as necessary. This scheme eliminates the necessity of the old method of dropping feeders until the faulty one is located.

If a visual indication is desired rather than a sound indication comparable readings can be taken with a vacuum-tube voltmeter used in place of the telephone receivers. With this set-up the grounded feeder would be indicated as that giving the highest meter reading.

The wiring diagram shows a representative installation covering three circuits. The system may be extended over as many circuits as may be desired. Ordinarily Western Electric jacks may be used. The bell-ringing transformer should be of at least 50-watt size so as to have the necessary current-carrying capacity to permit its insertion into the current transformer neutral. With the high-voltage winding of the bell transformer short-circuited, as it is normally, its low-voltage winding offers very little impedance in the neutral circuit. Therefore the effect upon relay operation is entirely negligible.



Typical application of grounded-feeder indicator.

Concrete Trolley Arches for Eastern Electrification

A novel feature in the electrification program of the Detroit, Toledo & Ironton Railroad is the use of reinforced concrete trolley arches. These arches are being manufactured by the company and are given a 24-hr. initial set period, a 24-hr. curing treatment under steam at from 90 to 130 deg., a 24-hr. drying period at the same temperature, and finally an 18-day outdoor seasoning period.

Each arch complete, exclusive of its foundation, contains about 7 cu.yd. of concrete and weighs something over 15 tons. It is considered that with this type of towers the maintenance will be negligible and that they will last a lifetime.

Action of Series-Connected Current Transformers

By E. C. GOODALE, Southern California Edison Company, Los Angeles

Metering installations often are incorrect, due either to a wrong initial connection or to a subsequent error incident to the loosening or breaking of one or more of the secondary leads. The particular instances to be considered in the following discussion are

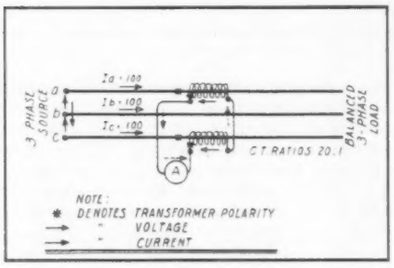


Figure 1

those on which the secondaries of the current transformers are connected in series, either initially or subsequent to installation.

Before considering the resultant action on meters involved in such connections it is advisable first to consider the action of the current transformers themselves. In 1925 a series of tests was made by the author on instrument transformers with secondaries connected in various series and parallel combinations. The parallel tests only proved what might have been predicted through a vector-analytical study.

Since series connections of current transformers are not in good standing in the engineering field and are met with only when errors in connections occur, the series tests are of particular interest. The tests were made in the meter-testing laboratory of the Syracuse Lighting Company of Syracuse, N. Y. The current transformers used were G.E. type W of 100/5 ratio. The quantitative value and phase relation of each voltage and current involved were determined and the following general law derived:

> When the secondaries of current transformers are connected in series the resultant current actually flowing in the secondary circuit will be the vector-average of the currents flowing through the primaries divided by the turn ratio in each case.

This assumes current transformers of like design and equal ratio in each case. It held true except for the case where the three transformers on the three legs of a 3-phase circuit had their secondaries all connected in series. Harmonic currents then were present in such large quantities that the true vector relations of the actual (fundamental) secondary current could

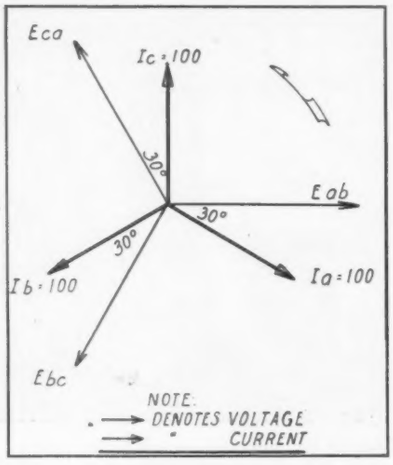


Figure 2

not be obtained with the apparatus at hand for the tests. When only two secondaries were connected in series, the third being shunted, the harmonic currents resulting were neglibible and the results followed the above-stated law very closely.

The law might be restated somewhat more specifically thus:

> If the secondaries of two current transformers of like ratio and design be connected in series, boosting, the actual current which will flow will be half the vector-sum of the currents flowing in their primaries, divided by the turn ratio. If connected bucking the actual current will be half the vector-difference, divided by the turn ratio.

In each case the vector-difference between what "ought to flow" and what actually flows in each secondary goes to magnetize the core of that transformer. This produces a correspondingly large voltage across both primary and secondary, similar to the action occurring when the secondary of a current transformer is opened.

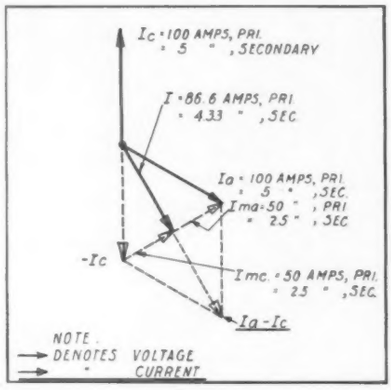


Figure 3

As an example, consider the case of two current transformers on a 3-phase, 3-wire circuit with secondaries in series and bucking shown in Fig. 1. Phase relations involved are shown in Fig. 2 for the condition of unity power factor and balanced load. The derivation of the value of the current actually flowing is shown in Fig. 3.

In Fig. 3 the current I is assumed to be flowing in the direction indicated by the dotted arrows, Fig. 1, and is equal to ½ (Ia-Ic) vectorially, that is, the actual current will be the vector-average-difference of Ia and Ic. The vector difference between this actual current, I, and current Ia, divided by the turn ratio will be the magnitude and vectorial position, or phase relation of the magnetizing current in phase A current transformer. The difference between —I and Ic will be the magnetizing current in phase C transformer.

To apply this principle to a metering problem take, as an example, the common case of the 2-element watthour meter used for power measurement on a 3-phase, 3-wire circuit. See Figs. 3 and 4. For the case of unity power factor and balanced load the true power consumed will be 1.732×10,000×100×1=1,732 kw. The metered power

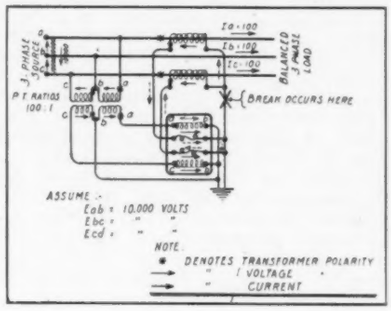


Figure 4

will be the sum of the power registered in the two elements, or:
Metered power,

$$A = Eab \times Ia \times \cos 30° = 10{,}000 \times 100 \times 0.866 = 866 \text{ kw.}$$

Metered power,

$$B = Ecb \times Ic \times \cos 30° = 10{,}000 \times 100 \times 0.866 = 866 \text{ kw.}$$

Total 1,732 kw.

However, suppose that the common negative in the current circuit is broken at X, Fig. 4. Then a plain series circuit will result, just as is shown in Fig. 1. Assuming the current to flow as indicated by the dotted arrows, Fig. 4, it will flow in opposite directions in the two elements of the meter. The current value will be ½(Ia-Ic)=4.33 amp., as shown in Fig. 3. This corresponds to a primary current of 86.6 amp.

This 86.6-amp. current reacting with voltage Eab at an angle of 60 deg., as shown in Fig. 6, will give a registration in meter element A of 10,000×86.6×0.5=433 kw. This same current passing in a reverse direction through element C, reacting with voltage Ecb at an angle of 120 deg., will be equivalent to a "positive" reaction at 60 deg. Thus the meter indication here, too, will be 433 kw. Therefore the

sum-total indication of the meter will be 833 kw. or 50 per cent of the actual power passing. This percentage always will hold good for this condition. Corresponding vector diagrams for other power factors will produce similar results.

The term "in series" as used in the foregoing discussion is limited strictly

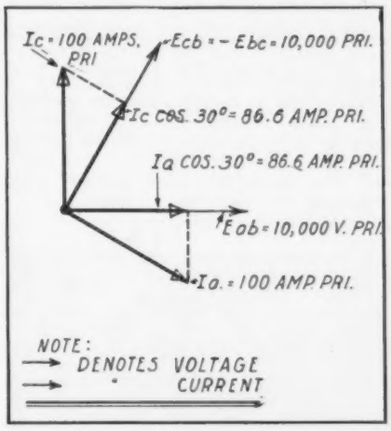

Ic = 100 AMPS. PRI
Ecb = - Ebc = 10,000 PRI.
Ic COS. 30° = 86.6 AMP. PRI.
Ia COS. 30° = 86.6 AMP. PRI.
Eab = 10,000 V. PRI.
Io. = 100 AMP. PRI.
NOTE:
DENOTES VOLTAGE
CURRENT

Figure 5

to mean only those cases wherein the secondary current from one transformer is forced to go through the secondary winding of another current transformer, with no intervening taps. Taps such as those used for relay actuation will change the conditions. This discussion is given as an analysis of the problem existing when such connections have been made in error or resulted from accident, and not as a recommendation for the use of a series connection. Such connections are understood universally to be harmful to the current transformers and dangerous to the meter tester.

The law developed already has been used as indicated in determining just how much power has been delivered to

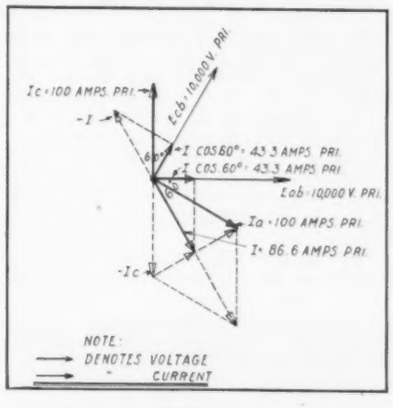


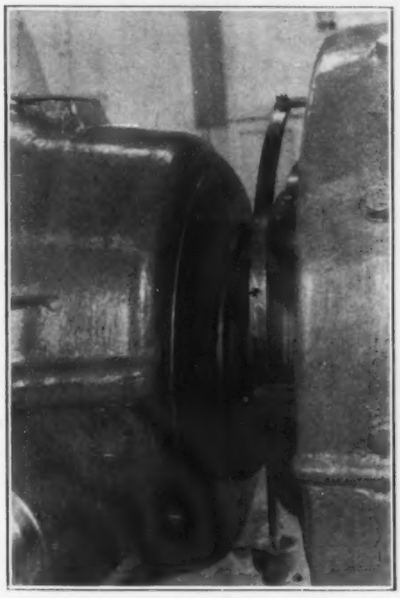
Figure 6

a customer during a period of operation under such connections. Knowing the meter registration and the period of time of operation, the correct figure of power passing the metering point may be determined accurately. The only error entering will be that incident to the voltage drop across the current transformer primaries, and which will be against the consumer in most normal installations, but practically negligible in magnitude.

Bearing Oil Creepage Stopped by Use of Felt Ring

Oil creeping out along the shafts of rotating machinery is always a source of more or less difficulty, particularly where exciters are mounted on the end of the main shaft. An easily applied method of effectively stopping such undesirable oil flow is shown in the accompanying illustration.

A ring of heavy felt fitted snugly around the shaft as shown serves to wipe off the creeping oil and to cause it to drain back into the bearing reservoir. The felt is held in place by means of a two-piece metal ring of about 3/16-in. thickness fastened to the bearing housing with flat-headed machine screws. The metal ring is just enough larger than the shaft to permit the passage of the felt between



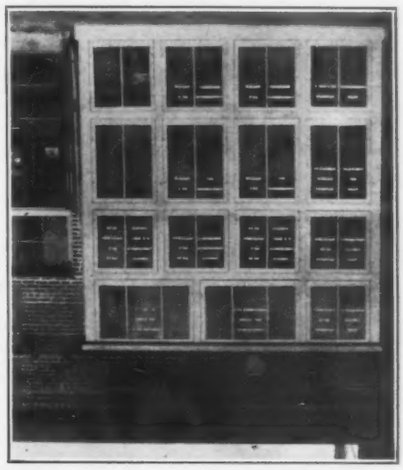
Felt ring around the shaft of a synchronous condenser to prevent oil-throwing.

and to hold the felt tightly against the shaft. This is a simple, effective and economical way of effecting a cure for this evil. The installation pictured is on a 12,500-kva. synchronous condenser at the Newark substation of the Pacific Gas and Electric Company.

Lifting Magnets Immersed in Acid Pickling Bath

The reduction of labor requirements from thirty-man-hours to two-man-hours for a given batch of material was accomplished by the Colonial Steel Company at its Colona, Pa., plant.

This company manufactures high-grade tool steel and steel for other special purposes. As these products must be particularly free from defects, the seams, dirt inclusions and other similar defects which usually show up on the outer surface of billets after they are rolled from ingots must be chipped out before rolling them to finished sizes. To facilitate the necessary inspection, all of the billets and bars are placed first in a pickling bath to remove the outside scale and dirt. After this has been accomplished it is easy to detect the flaws and chip them out with air chipping hammers. This



Outdoor switch cells at the compressor station of the San Diego Consolidated Gas & Electric Company. Remote control is provided from the compressor room thus insuring maximum safety. The plant has been expanded to a total capacity of 2,600 hp.

process naturally results in a finer grade steel. It is in this pickling department that the aforementioned reduction in labor cost has been made. Formerly all of the metal bars had to be stacked into the acid tubs by hand and required six men working together five hours to fill one tub. By placing two standard E. C. & M. rectangular lifting magnets together end to end to form one continuous magnet 52 in. long, a magnetic lifting unit was formed which just fitted the acid tubs. The electrical circuits of the two magnets were connected together to form a common unit and led to a common controller.

By the use of this magnet it is possible to lay one complete layer of billets or bars into the acid tubs at one operation. This is much faster than the old hand-method, and the job of loading one of these acid tubs now takes two men but one hour.

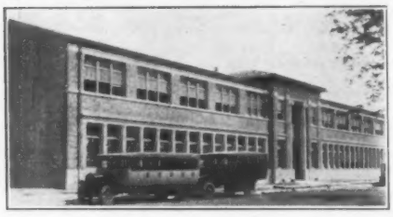
One of the interesting features of this application is the fact that it is necessary for this lifting magnet to be immersed in the acid in order to place and remove the billets and bars from the pickling bath. Furthermore, when the bars are lifted from the bath a high-pressure spray of water is directed over the bars and magnet to remove traces of acid and debris. This would seem to be rather severe service for an electrical device, but service has been entirely satisfactory during the long period of operation of this apparatus.

Digestion can be stimulated, say those purported to know, by placing an electric light on the abdomen after eating. Light from an ordinary incandescent lamp, it seems, has a germicidal effect and will relieve pain. This is a discovery of social prominence and consequence. Soon we may expect the well appointed table to include a convenience outlet at each place. Gentlemen after dinner will carry lights amidships to indicate that they have dined. —H.U.

IDEAS FOR THE CONTRACTOR

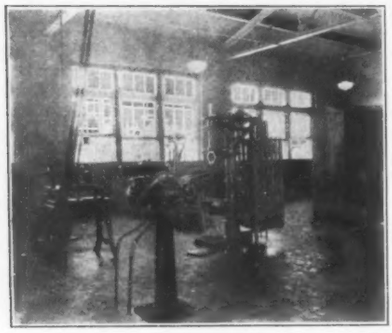
Kern High School Shop Well Equipped Electrically

More than usual in its completeness in individual motor drive shop equipment is the recently completed Kern County Union High School shop building in Bakersfield, Calif. Every one of the 32 machines in the shop is individually driven by a direct-connected motor.



The Kern Union High School, Bakersfield, Calif., in whose shop building modern electric equipment is used to advantage.

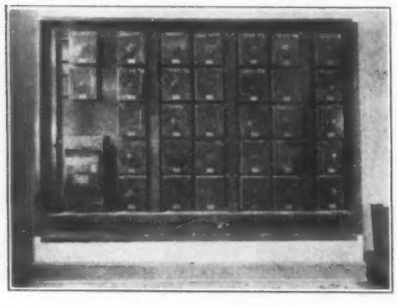
Each of the 32 motor-driven machines in the shop is individually controlled by a G.E. CR-7006-D-4 magnetic switch control. Control buttons



Each machine has its individual motor drive in the machine shop.

are located at convenient places on each machine.

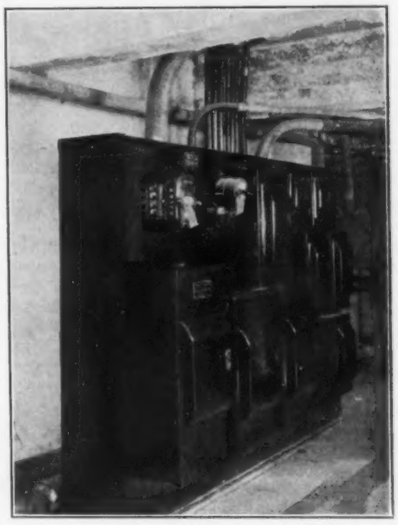
In each case the source of energy is brought to the machine through the pull box extended through the concrete floor from the ceiling below. In making the connections to the machines through the floor, nipples were used. In supporting the conduit and fixtures on 10-ft. centers conduit was brought in through the concrete roof. This was installed during the course of construction of the building.



The shop switchboard, with individual remote control for each machine.

The switchboard arrangement consists of flat copper bus bars extending the full length of the board with the switches bolted into the copper bus. The switchboard cabinet was made of No. 12 gage iron. Circle T switches were used.

The main-line switch is for 600 amp., 250 volts; the lighting switch, 400 amp. and the power switch, 400 amp. The board itself is 12 in. x 6 ft. high x 8 ft. long. A 4-in. conduit service containing three 900,000 circ.mil cables is used to feed the power. Three 750,000 circ.mil cables are used for the lighting. The board was designed and manufactured by the Star Electric Company of Bakersfield.



Main switchboard for the Kern Union High school, located in the basement.

At the Other Fellow's Price

(Something worth reading, taken from the bulletin of the California Electragists, Southern Division.)

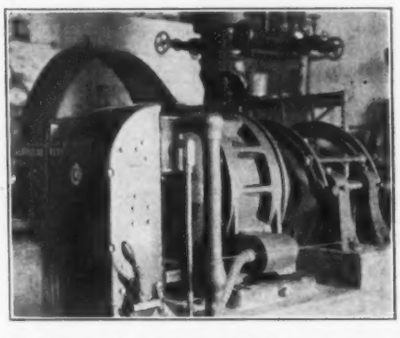
Continued interest in the possibilities of the house wiring field is suggested from many sources as timely and beneficial. Present indication leads to the conclusion that much good house wiring business is being passed up by Southern California Electragists "because house wiring is unprofitable AT THE OTHER FELLOW'S PRICE." Obviously this is true. Superior ability for handling the customer's work combined with a new constructive selling effort produces a different result. The average Electragist will profit if he goes after house wiring business intelligently right now.

The contractor who is working consistently to establish a reputation for high class work is sure to prosper in the long run. House wiring is no exception among the specialties and presents a tremendous and continuous potential market. The Red Seal Plan offers your best tangible means for augmenting your own effort and ability on house wiring sales. Those most successful in Red Seal sales advise us that emphasis on the idea of complete and modern electrical service for the home, with no more than NECESSARY reference to the wiring job itself, produces the quickest and most substantial results. Forget that you are selling an electrical installation, rather directing your prospect's attention to the living conveniences your installation will provide for him.

Motor Drive Substituted for Shaft Drive in Ice Plant

The advantage of electric drive over steam in an ice and cold-storage plant was demonstrated recently in the instance of the San Luis Ice & Cold Storage Company of San Luis Obispo, Calif. Cline's Electric Shop was responsible for the changeover to electric drive which brought the plant up from 2 electric motors to 14, with a total load of 100 hp. and a capacity of 150 hp.

The plant formerly was operated by means of shaft drive. Mr. Cline re-

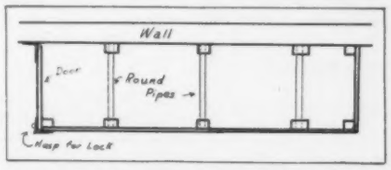


Method employed by contractor to connect motor and control on substitution of electric motor for shaft drive in ice plant.

wired and changed it to individual motor drive. The service to each motor is 500,000 circ.mil cable in 4-in. conduit. New main and sub-distribution boards were installed. The method of connection is shown in the accompanying photograph.

Lock Conduit Rack May be Made Simply with Pipe and Wood

A simple though very effective conduit rack may be made with little effort and provided with means of locking the conduit in the rack. The accompanying drawing shows the general plan, and the photograph the result.



Simple plan for construction of lockable conduit rack from wood and pipe.

This particular rack was made so that it could be filled from the end and located in the storeroom in such position that a truck might back up to the open end. The rack can be locked, the stockman given charge of the key and conduit cannot be removed without unlocking it.

The smaller sizes of conduit would ordinarily be stored in the top section, large sizes being graded in the lower racks. The floor portion can be used for short pieces or metal moulding.

Lock conduit rack completed. Conduit is removable only from the locked end. Small pieces or metal moulding can be stored in bottom section.

Electrical Estimating for the Contractor—XVII

Further Consideration of Pump Characteristics, with Tables Facilitating Estimating Load

By J. R. WILSON*, Quality Electric Works, Los Angeles

The pipe which is placed below the pump is known as the suction pipe and the pipe placed above the pump is known as the discharge pipe. The suction pipe is designated "hs" and the discharge pipe is designated "hd." The total head equals "hs" plus "hd" plus the friction in the pipe from inlet to outlet. The work of the pump consists in lifting the water or other substance the distance of "hs" by the difference of pressure at the suction inlet of the pump and the higher pressure on the surface of the water outside. The outside pressure is usually "one atmosphere" (equal to 34 ft.) therefore the highest theoretical-suction lift will be 34 ft. (at sea level) less pipe friction and the pressure required to cause the water to flow up the suction pipe. This is known as the "velocity head."

Important Considerations

If the water to be lifted is hot, other factors must also be considered. Water at high temperature will turn into steam at a pressure below that at which it will remain in a state of water. Hot water cannot be lifted very high and very hot water cannot be lifted at all. This is so because a low pressure at the runner inlet (necessary to lift the water) would convert the water into steam at that point. Because of this, boiler feed pumps are placed so that the water flows to the pumps under pressure. Whenever it is necessary to pump hot water, the pump manufacturer should be consulted.

The performance of a centrifugal pump is dependent upon the design of the pump runner. If the speed of the pump is changed the capacity will be changed in direct proportion to the speed change. Also the head will change in direct proportion to the square of the speed and the horsepower in direct proportion to the cube of the speed. For the aforementioned reasons it is necessary to run the pump at the correct speed if a certain desired capacity is to be obtained. In applying motors to pumps great care should be taken to specify the cycles of the current supply. Reference to Table XI will serve to make this point clearer. As will be noted there is a difference of approximately 16 per cent between 50 and 60 cycle speeds. With belt-driven installations this difference sometimes can be overcome by proper selection of pulley sizes.

Terms and Definitions

For the benefit of those estimators who have not had an extended experience with the data, rules and phraseology pertaining to water and pumping equipment a number of these are given herewith:

One million U.S. gallons in 24 hours=to the following:

	24 Hours	1 Hour	1 Minute	1 Second
Gallons	1,000,000	41,666.66	694.44	11.574
Cubic feet	133,680	5,570	92.833	1,574
Cubic inches	231,000,000	9,624,960	160,416	2,673.6
Pounds	8,340,000	347,498	4,791.63	96.527

The mean pressure of the atmosphere usually is estimated at 14.7 lb. per sq.in., so that with a perfect vacuum it will sustain a column of mercury 30 in., or of water 34 ft., but it is not a good practice to operate centrifugal pumps over 18 or 20 in. vacuum for altitudes of 2,500 ft. or under, or 10 to 12 in. vacuum for altitudes of 5,000 ft. or under.

Head: Distance from level of liquid at intake, on a vertical line, to the level of liquid at discharge.

Friction Head: Friction in pipes and pump.

Gal. per Min.: Gallons per minute.

Miner's Inch: Amount of water which will flow through an opening 1 in. square in a plank 2 in. thick, under a head of 4 in. above the upper edge of the opening.

Miner's Inch=11.2 gal. per min. (California and Arizona).

Miner's Inch=9.0 gal. per min. (Utah, Idaho, Montana, Nevada, New Mexico, Oregon, Washington.)

Miner's Inch=11.7 gal. per min. (Colorado).

1 cu.ft. per second=449 gal. per min.
1,000 lbs. per hour=2 gal. per min.
1 acre-ft.=326,000 gallons.
1 lb.ft.=12 gal.
1 atmosphere=34 ft. head.
1 in. of mercury=1.134 ft. head.
1 cu.in.=.0361 lb.
27.7 cu.in.=1 lb. weight.
1 c.ft=62.4245 lb.@39 deg. F.
1 cu.ft.=62.4245 lb.@39 deg. F.
1 U.S. gal.=8.33111 lb. (distilled).
1 U.S. gal.=8.34 (ordinary practice).
1 U.S. gal.=231 cu. in.
1 imperial gal.=10 lb.@62 deg. F.
1 lb. pressure=2.31 ft. in height.
1 ft. height=.433 lb.

To convert any of the above to the Imperial standard multiply by the factor 1.2.

The mean pressure of the atmosphere at sea level is estimated at 14.7 lb. per sq.in.

To find the pressure in pounds per sq.in. of a column of water, multiply the height in feet by 1.433. Approximately every foot elevation equals one-half lb. pressure per sq.in. allowing for ordinary friction.

Doubling the diameter of a pipe increases its capacity four times.

Friction of liquids in pipe increases as the square of the velocity.

Making allowance for evaporation it requires 28,320 gallons of water to irrigate 1 acre 1 in. deep.

It requires from 10 to 20 in. of water per acre to produce a crop by irrigation, the average being 16 in. The actual amount required depends upon the crop and the season.

Flooding alfalfa 6 in. deep will wet the soil 4 ft. from the surface. Flooding orchards 4 in. deep will wet the soil 4 ft. from the surface.

The power required for pumping depends upon the weight of the liquid to be pumped per minute and the vertical height from intake to outlet. To this must be added the allowance for friction.

$$\text{Theoretical horsepower} = \frac{\text{Wt. of liquid} \times \text{ht. in ft.}}{33{,}000}$$

$$\text{Actual horsepower: H.P.} = \frac{W \times H}{33{,}000 \times E}$$

W = Wt. of liquid.
H = Total head including friction.
E = Efficiency of pump.

Example

To pump water 500 gal. per min. against 50 ft. combined "hs" and "hd;" pipe line 4 in. in diameter, 200 ft. long, with three 90-deg. elbows, and a pump efficiency of 65 per cent.

From Table I we get:

Friction loss for 100 ft. 4-in. pipe discharging 500 gal. per min. = 17.2. For 200 ft. = 2 × 17.2 = 34.4 ft.

* All rights reserved by the author.

From Table II we get:

Friction loss in one 4-in. 90-deg. elbow, discharging 500 gal. per min. = 2.47, three elbows = 3 × 2.47 = 7.4 ft.

Total head = 50 + 34.4 + 7.4 = 91.8 ft.

Water weighs 8.33 lb. per U.S. gal. Weight pumped per min. will be 8.33 × 500 = 4,165 lb.

Formula:

$$\text{Hp.} = \frac{4{,}165 \times 91.8}{33{,}000 \times .65} = 17.8 \text{ hp.}$$

Direct Flow Turbine Type

Another type of deep-well pump which has proved of very high efficiency is the direct-flow turbine type. Among the claims made for this type of pump the following should prove of interest:

1. Large capacity with small diameter well.
2. Impellers so placed as to reduce internal pressure to less than 3 lb. in any part.
3. Water raised in straight upward line with no angles to retard flow.
4. Permits extensions to be made (should water bearing level recede) without affecting speed, capacity, or efficiency.
5. Minimum effect from gassy wells, there being no pockets to cause air lock.

A very large number of these pumps is in successful operation in deep well districts of the western states, and investigation of their merits will well repay the effort.

Where large quantities of water are to be pumped against varying heads (with heads of from zero to 8 or 10 ft.) the problem has presented considerable difficulty. Where the head is absolutely unchanging, the use of a scroop wheel has proved very efficient, but where the head varies over a foot or two above or below the rating for which the wheel is designed the efficiency of the wheel falls to zero. Again, the use of a centrifulgal pump on a head of only 2 or 3 ft. is impractical because the efficiency may fall to as low as 20 to 30 per cent, especially so if the head be varying.

TABLE III

Note—This table is based upon a mechanical efficiency of 100 per cent for the pumping unit. To get the actual horsepower required, divide the result obtained from the table by the efficiency of the pumping unit expressed as a decimal.

Where the pressure in pounds per square inch against which the pump has to operate is given instead of the head in feet it can be converted into head by multiplying by 2.31 as each pound per square inch of pressure is equal to the pressure of a head of water 2.31 feet.

***Table of Theoretical Horsepower required to raise Water to different Heights.**

Gal. per Min.	FEET HEAD																		
	5	10	15	20	25	30	35	40	45	50	60	75	90	100	125	150	175	200	250
5	.006	.012	.019	.025	.031	.037	.044	.05	.06	.06	.07	.09	.11	.12	.16	.19	.22	.25	.31
10	.012	.025	.037	.050	.062	.075	.087	10	.11	.12	.15	.19	.22	.25	.31	.37	.44	.50	.62
15	.019	.037	.056	.075	.094	.112	.131	.15	.17	.19	.22	.28	.34	.37	.47	.56	.66	.75	.94
20	.025	.050	.075	.100	.125	.150	.175	.20	.22	.25	.30	.37	.45	.50	.62	.75	.87	1.00	1.25
25	.031	.062	.093	.125	.156	.187	.219	.25	.28	.31	.37	.47	.56	.62	.78	.94	1.09	1.25	1.56
30	.037	.075	.112	.150	.187	.225	.262	.30	.34	.37	.45	.56	.67	.75	.94	1.12	1.31	1.50	1.87
35	.043	.087	.131	.175	.219	.262	.306	.35	.39	.44	.52	.66	.79	.87	1.08	1.31	1.53	1.75	2.19
40	.050	.100	.150	.200	.250	.300	.350	.40	.45	.50	.60	.75	.90	1.00	1.25	1.50	1.75	2.00	2.50
45	.056	.112	.168	.225	.281	.337	.394	.45	.51	.56	.67	.84	1.01	1.12	1.41	1.69	1.97	2.25	2.81
50	.062	.125	.187	.250	.312	.375	.437	.50	.56	.62	.75	.94	1.12	1.25	1.56	1.87	2.19	2.50	3.12
60	.075	.150	.225	.300	.375	.450	.525	.60	.67	.75	.90	1.12	1.35	1.50	1.87	2.25	2.62	3.00	3.75
75	.093	.187	.281	.375	.469	.562	.656	.75	.84	.94	1.12	1.40	1.69	1.87	2.34	2.81	3.28	3.75	4.69
90	.112	.225	.337	.450	.562	.675	.787	.90	1.01	1.12	1.35	1.68	2.02	2.25	2.81	3.37	3.94	4.50	5.62
100	.125	.250	.375	.500	.625	.750	.875	1.00	1.12	1.25	1.50	1.87	2.25	2.50	3.12	3.75	4.37	5.00	6.25
125	.156	.312	.469	.625	.781	.937	1.094	1.25	1.41	1.56	1.87	2.34	2.81	3.12	3.91	4.69	5.47	6.25	7.81
150	.187	.375	.562	.750	.937	1.125	1.312	1.50	1.69	1.87	2.25	2.81	3.37	3.75	4.69	5.62	6.56	7.50	9.37
175	.219	.437	.656	.875	1.093	1.312	1.531	1.75	1.97	2.19	2.62	3.28	3.94	4.37	5.47	6.56	7.66	8.75	10.94
200	.250	.500	.750	1.000	1.250	1.500	1.750	2.00	2.25	2.50	3.00	3.75	4.50	5.00	6.25	7.50	8.75	10.00	12.50
250	.312	.625	.937	1.250	1.562	1.875	2.187	2.50	2.81	3.12	3.75	4.69	5.62	6.25	7.81	9.37	10.94	12.50	15.72
300	.375	.750	1.125	1.500	1.875	2.250	2.625	3.00	3.37	3.75	4.50	5.62	6.75	7.50	9.37	11.25	13.12	15.00	18.75
350	.437	.875	1.312	1.750	2.187	2.625	3.062	3.50	3.94	4.37	5.25	6.56	7.87	8.75	10.94	13.12	15.31	17.50	21.87
400	.500	1.000	1.500	2.000	2.500	3.000	3.500	4.00	4.50	5.00	6.00	7.50	9.00	10.00	12.50	15.00	17.50	20.00	25.00
500	.625	1.250	1.875	2.500	3.125	3.750	4.375	5.00	5.62	6.25	7.50	9.37	11.25	12.50	15.62	18.75	21.87	25.00	31.22

*Allowance should be made for friction.

TABLE IV

Table converting inches vacuum into feet suction

Inch Vacuum	Feet	Inch Vacuum	Feet	Inch Vacuum	Feet	Inch Vacuum	Feet
1	1.13	6	6.80	12	13.61	22	24.95
1½	1.70	6½	7.37	13	14.74	23	26.08
2	2.27	7	7.94	14	15.88	24	27.22
2½	2.84	7½	8.50	15	17.01	25	28.35
3	3.41	8	9.07	16	18.14	26	29.48
3½	3.98	8½	9.64	17	19.28	27	30.62
4	4.54	9	10.21	18	20.41	28	31.75
4½	5.11	9½	10.77	19	21.55	29	32.89
5	5.67	10	11.34	20	22.68	30	33.74
5½	6.23	11	12.47	21	23.81		

TABLE V

Table converting feet head of water to pressure per square inch

Feet Head	Pounds per Square Inch	Feet Head	Pounds per Square Inch	Feet Head	Pounds per Square Inch
1	.43	55	23.82	190	82.29
2	.87	60	25.99	200	86.62
3	1.30	65	28.15	225	97.45
4	1.73	70	30.32	250	108.27
5	2.17	75	32.48	275	119.10
6	2.60	80	34.65	300	129.93
7	3.03	85	36.81	325	140.75
8	3.40	90	38.98	350	151.58
9	3.90	95	41.14	375	162.41
10	4.33	100	43.31	400	173.24
15	6.50	110	47.64	500	216.55
20	8.66	120	51.97	600	259.85
25	10.83	130	56.30	700	303.16
30	12.99	140	60.63	800	346.47
35	15.16	150	64.96	900	389.78
40	17.32	160	69.29	1000	433.09
45	19.49	170	73.63		
50	21.65	180	77.96		

TABLE VI

Table converting pressure per square inch to feet head of water

Pounds per Square Inch	Feet Head	Pounds per Square Inch	Feet Head	Pounds per Square Inch	Feet Head
1	2.31	55	126.99	180	415.61
2	4.62	60	138.54	190	438.90
3	6.93	65	150.08	200	461.78
4	9.24	70	161.63	225	519.51
5	11.54	75	173.17	250	577.24
6	13.85	80	184.72	275	643.03
7	16.16	85	196.26	300	692.69
8	18.47	90	207.81	325	750.41
9	20.78	95	219.35	350	808.13
10	23.09	100	230.90	375	865.80
15	34.63	110	253.98	400	922.58
20	46.18	120	277.07	500	1154.48
25	57.72	125	288.62		
30	69.27	130	300.16		
35	80.81	140	323.25		
40	92.36	150	346.34		
45	103.90	160	369.43		
50	115.45	170	392.52		

TABLE VII

IRRIGATION WATER QUANTITY TABLES

QUANTITY OF WATER REQUIRED TO COVER ONE ACRE TO DEPTH STATED			"SECOND FEET," CHANGED TO GALLONS, ALSO "ACRE FEET" FOR GIVEN PERIODS OF TIME							GALLONS REQUIRED TO COVER GIVEN NUMBER OF ACRES TO A DEPTH OF ONE (1) FOOT		
Depth in Inches or Acre Inches	Cubic or Second Feet on One Acre	Gallons to Cover One Acre	Number of Second Feet	Gallons in One Minute's Flow	Gallons in One Hour's Flow	Gallons in Twelve Hours' Flow	Gallons in Twenty-four Hours' Flow	Acre Feet in One Hour's Flow	Acre Feet in Twelve Hours' Flow	Acre Feet in Twenty-four Hours' Flow	Number of Acres	Gallons to Cover One Inch Deep	Gallons to Cover One Foot Deep
1	3630	27154	.25	112.2	6732 0	80790	161580	0207	.2479	4958	1	27154	325851
2	7260	54309	.50	224.4	13464.0	161579	323158	.0413	4959	.9918	2	54309	651703
3	10890	81463	.75	336.6	20196.0	242369	484738	0620	7438	1.4876	3	81462	977554
4	14520	108617	1.00	448.8	26928.0	323158	646316	0826	9917	1.9834	4	108617	1303406
5	18150	135771	1.25	561.0	33660.0	403948	807896	1033	1.2397	2.4794	5	135821	1629257
6	21780	162926	1.50	673.2	40392.0	484738	969476	.1231	1.4876	2 9752	6	162926	1955109
7	25410	190080	1.75	785.5	47130.0	565527	1131054	.1446	1.7355	3.4710	7	190080	2280960
8	29040	217234	2.00	897.7	53862 0	646317	1292634	.1653	1 9835	3 9670	8	217234	2606812
9	32670	244389	2.50	1222.1	67326.0	807896	1615792	.2066	2.4793	4.9586	9	244389	2932663
10	36300	271542	3.00	1346.5	80790.0	969475	1938950	.2479	2.9752	5.9504	10	271543	3258515
11	39930	298697	4.00	1795.3	107718.0	1292634	2585268	.3306	3 9669	7 9538	15	407314	4887772
12	43560	325851	5.00	2244.2	134532.0	1615792	3231584	4132	4.9586	9.9172	20	542669	6512096
14	50820	380160	6.00	2693 0	161580.0	1938951	3877902	.4959	5.9503	11.9006	25	678857	8146285
16	58080	434469	7.00	3141.8	188508.0	2262109	4524218	.5785	6.9421	13.8842	30	814629	9775544
18	65340	488777	8.00	3590.6	215436.0	2585268	5170536	.6612	7 9338	15.8676	40	1086172	13034058
20	72600	543086	9.00	4039.5	242370.0	2908426	5816852	.7438	8.9255	17.8510	60	1629257	19551087
22	79860	597394	10.00	4488.3	269298.0	3231585	6463170	.8264	9 9173	19.8346	80	2172343	26068116
24	87120	651703	20 00	8976.6	538596.0	6463170	12926340	1 6529	19.8345	39.6692	160	4344686	52136232

The "Second Foot" is the constant flow of one cubic foot per second (exact 7.48052 gallons). The "Acre Foot" is the quantity of water required to cover one acre (12) inches deep.

TABLE VIII

Flow of Water in Concrete Pipes

Head in Feet per 1000 Ft. of Pipe Line	8 Inch Pipe Running Full		10 Inch Pipe Running Full		12 Inch Pipe Running Full		14 Inch Pipe Running Full		16 Inch Pipe Running Full		20 Inch Pipe Running Full		24 Inch Pipe Running Full	
	Cubic Ft. per Second	Miner's Inches	Cubic Ft. per Second	Miner's Inches	Cubic Ft. per Second	Miner's Inches	Cubic Ft. per Second	Miner's Inches	Cubic Ft. per Second	Miner's Inches	Cubic Ft. per Second	Miner's Inches	Cubic Ft. per Second	Miner's Inches
.5..	.24	12.0	.44	22.4	.74	37.3	1.15	57.5	1.64	82.4	3.04	152.	5.01	250.
.6..	.26	13.2	.49	24.6	.82	41.0	1.26	63.0	1.81	90.5	3.44	172.	5.51	275.
.7..	.28	14.2	.53	26.5	.88	44.2	1.30	65.4	1.95	97.5	3.60	180.	5.94	297.
.8..	.30	15.3	.56	28.4	.94	47.4	1.45	72.8	2.09	104.5	3.86	193.	6.36	318.
.9..	.32	16.2	.60	30.1	1.00	50.2	1.54	77.2	2.21	110.9	4.09	204.	6.74	337.
1.0..	.34	17.0	.63	31.7	1.05	52.9	1.62	81.4	2.45	122.5	4.32	216.	7.10	355.
1.5..	.41	20.9	.77	38.8	1.29	64.8	1.99	99.6	2.86	143.0	5.28	264.	8.70	435.
2.0..	.48	24.1	.90	45.0	1.49	74.7	2.30	115.0	3.30	165.0	6.10	305.	10.04	502.
3.0..	.59	29.5	1.10	55.0	1.83	91.5	2.81	140.6	4.04	202.0	7.46	373.	12.30	615.
4.0..	.68	34.1	1.27	63.5	2.11	105.9	3.25	162.5	4.67	233.5	8.62	431.	14.20	710.
5.0..	.76	38.2	1.42	71.0	2.36	118.0	3.63	181.5	5.21	260.5	9.64	482.	15.85	792.
6.0..	.83	41.8	1.55	77.8	2.59	129.5	3.99	199.7	5.72	286.0	10.58	529.	17.41	870.
7.0..	.90	45.2	1.68	84.0	2.80	140.0	4.30	215.0	6.18	309.0	11.40	570.	18.80	940.
8.0..	.96	48.3	1.79	89.9	3.00	150.0	4.61	230.5	6.61	330.5	12.40	620.	19.88	994.
9.0..	1.02	51.2	1.90	95.3	3.18	159.0	4.88	244.0	7.00	350.0	12.94	647.	21.30	1065.
10.0..	1.10	55.0	2.01	100.5	3.35	157.5	5.15	257.5	7.38	369.0	13.65	682.	22.46	1123.
12.0..	1.18	59.1	2.20	110.0	3.67	183.5	5.64	282.0	8.10	405.0	14.95	747.	24.60	1230.
14.0..	1.28	64.0	2.38	119.0	3.96	198.0	6.10	305.0	8.75	437.6	16.15	807.	26.60	1330.
16.0..	1.36	68.2	2.54	127.0	4.24	212.0	6.51	325.5	9.35	467.6	17.26	863.	28.40	1420.
18.0..	1.45	72.5	2.70	135.0	4.48	224.0	6.90	345.0	9.90	495.0	18.31	915.	30.20	1510.
20.0..	1.52	76.1	2.83	141.8	4.74	237.0	7.26	363.0	10.41	520.5	19.26	963.	31.70	1585.
22.0..	1.60	80.1	3.03	151.5	4.81	240.5	7.30	385.0	11.05	552.5	20.20	1010.	33.68	1684.
24.0..	1.68	84.0	3.20	161.0	5.07	253.5	8.14	407.0	11.69	584.6	21.26	1060.	35.58	1779.
26.0..	1.76	88.2	3.42	171.0	5.32	266.0	8.58	429.0	12.32	616.0	22.00	1110.	37.48	1874.
28.0..	1.85	92.5	3.62	181.0	5.58	279.0	9.20	451.0	12.97	648.6	23.20	1160.	39.38	1969.
30.0..	1.92	96.1	3.83	191.8	5.84	292.0	9.46	473.0	13.01	650.5	24.20	1210.	41.28	2064.

This problem was first solved successfully by A. B. Wood, chief engineer of the New Orleans Sewage and Water Board. Mr. Wood has perfected the design of a screw pump which works with maximum efficiency on a wide range of lifts. The basic design of this pump is a cylindrical casing containing a propellor discharging the water radially through the pump. There is a slight revolving motion imparted to the water as it passes

TABLE XI

Approximate Full Load R.P.M.

No. of Poles	60 Cycle	50 Cycle
4	1760	1450
6	1160	950
8	870	725
10	690	585
12	575	480
14	490	420
16	435	365

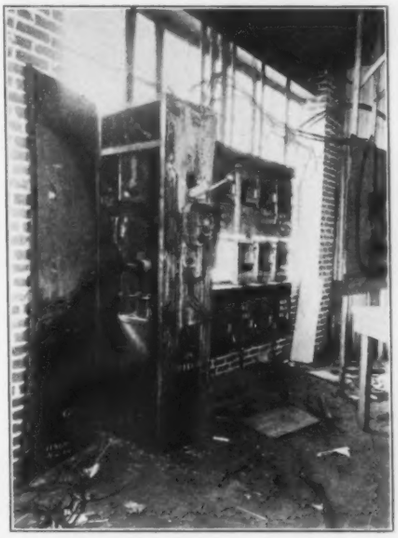
through the propellor, this motion being arrested by the use of stationary diffusion vanes, thus avoiding sudden change of velocity.

The inlet and outlet nozzles are about the same diameter and are of such proportions that the water is picked up at low velocity and discharged at about the same velocity. The operation of this pump is such that the horse power increases with the head and decreases as the pumping head lowers, thus tending to higher efficiency and lowered operating cost.

From tests made under the most favorable conditions the following relative efficiencies were obtained:

Head	Centrifugal	Screw Pump
2	20%	60%
4	38%	70%
6	55%	76%
8	67%	78%
10	75%	75%

In the past many large irrigation and reclamation projects have been shelved owing to lack of available pumping equipment which would operate at high enough economy to justify the installation cost. Since the advent of the screw type of pump these projects have been revived and many of them now are being carried to completion.



This blow-up was the result of an "iron-clad" wiring job being neither properly nor sufficiently grounded outside the building. The breakdown occurred on the consumer's premises ahead of all fuses.

TABLE IX

Depth of Water on Crest	Discharge		Depth of Water on Crest	Discharge		Depth of Water on Crest	Discharge	
Inches	Cubic Feet Per Second	Gallons Per Minute	Inches	Cubic Feet Per Second	Gallons Per Minute	Inches	Cubic Feet Per Second	Gallons Per Minute
1	.08	36.0	3	.42	189.	5	.91	408.
1⅛	.10	45.0	3⅛	.45	202.	5⅛	.94	422.
1¼	.11	49.5	3¼	.47	211.	5¼	.97	436.
1⅜	.13	58.5	3⅜	.50	225.	5⅜	1.01	455.
1½	.15	67.5	3½	.53	238.	5½	1.04	468.
1⅝	.17	76.5	3⅝	.56	252.	5⅝	1.08	486.
1¾	.19	85.5	3¾	.59	265.	5¾	1.12	504.
1⅞	.21	94.5	3⅞	.62	279.	6	1.19	536.
2	.23	103.5	4	.65	292.	6¼	1.26	567.
2⅛	.25	112.3	4⅛	.68	306.	6½	1.34	603.
2¼	.27	121.2	4¼	.71	319.	6¾	1.42	638.
2⅜	.30	135.0	4⅜	.74	333.	7	1.50	675.
2½	.32	143.7	4½	.77	346.	7¼	1.58	711.
2⅝	.34	153.0	4⅝	.81	364.	7½	1.66	747.
2¾	.37	166.2	4¾	.84	378.	7¾	1.75	787.
2⅞	.40	180.0	4⅞	.87	391.	8	1.83	823.

Question Box

Arrangements have been made to answer through the columns of the Journal of Electricity such questions on electrical construction and other subjects as are of general interest. Inquiries should be sent to the Editor, Journal of Electricity, 883 Mission Street, San Francisco.

Q. 9. Can you give me a table of temperature coefficients in relation to resistance?—H. J. S.

A.

Metal	Values of T. Deg. F.	Deg. C.
Silver	.00222	.00400
Copper (annealed)	.00242	.00428
Aluminum (99%)	.00235	.00423
Platinum	.00137	.00247
Iron	.00347	.00625
Tin	.00245	.00440
Lead	.00228	.00411
Bismuth	.00197	.00354
Mercury	.00044	.00072
German silver (ave.)	.00019	.00033

Formulae: For rise in temp.:

$Ri = R\ [1 + (T \times F^\circ \text{ rise})]$

For fall in temp.:

$Ri = R\ [1 - (T \times F^\circ \text{ fall})]$

Represents the increase or decrease per hour per degree F. or C.

Q. 10. What is the relation between the resistance of distilled water and that of copper?—B.L.N.

A. According to Culley, the resistance of dstilled water is 6,754 million times that of copper.

Q. 11. What is the elastic limit of No. 0 hard drawn copper wire?—Wm. H.

A. 39,645 lb. per sq.in. (average).

Q. 12. What is the weight of a cedar pole of 30-ft. length and 7-in. top? How many poles to a carload?—I.N.P.

A. 420 lb. (average) and 75 to the car.

Q. 13. What should be the sag of No. 12 copper wire on poles 100 ft. apart at 100 deg.?—R.J.T.

A. The sag should be 7 in. at span center.

Q. 16. What brand of steel is best suited for permanent magnets?—E.L.B.

A. Tungsten steel. Chrome steel is also good.

BETTER MERCHANDISING

Lighting by Rule is Method of Fixture Dealer

A novel booklet in which a small, wooden ruler is inserted in the front cover and bearing the title, "A Rule for Correct Lighting," has proved to be a successful means of arousing interest in fixtures for the English Company, Portland electrical fixture dealers.

The inside of the pamphlet is attractively printed and contains in convenient form workable suggestions as to the placing of switches, fixtures and outlets in the home.

The pamphlet states that it is being mailed to the recipient because there are certain fundamentals which must be observed if the lighting scheme is to be correctly carried out in the home. It asks the reader to bear in mind that the company does no wiring and that the suggestions and recommendations are applicable to the great majority of homes. The height of brackets is given, the locations of lights and switches as well as the types preferable. These are listed for porch, hall, living room, dining room, kitchen, bathroom and bedrooms.

The following excerpts from the text itself will show with what directness and simplicity the information is written, much of the effectiveness of the pamphlet being due to the well worded presentation of this information.

The following suggestions and recommendations are applicable to the great majority of homes.

Do not allow guesswork to enter into the wiring of your home or the placing of switches or outlets.

General

Height of Brackets—Not over 5 ft. 6 in. to 5 ft. 9 in. from finished floor.

Porch—Preferable locations:

1. Either side of door.
2. Over door.
3. Ceiling of porch.

Control switch inside hall.

Style—Conform strictly to architecture.

See that house number is visible at night.

Hall Location:

Ceiling fixture controlled by switch.

Also on 3-way switch if bedrooms are upstairs.

Catchy little booklet on home illumination sent out to prospects by the English Company of Portland, Ore.

Brackets over either side of console table if one is used.

Fixture should express warmth and hospitality.

Living Room—Do not put brackets over mantel—put plugs in shelf.

Two kinds of lighting are required:

(a) General illumination for conversational purposes.

(b) Reading lamps.

Shall a ceiling fixture be installed? Let us discuss this with you pro and con.

Let us show you how you can read in any part of the living room without a ceiling fixture.

Provide plenty of base plugs for reading lamps.

Dining Room—Run three wires to dining room center so you can have use of toaster or percolator on the table without burning the light. This is especially convenient during breakfast.

Illumination should express hospitality and intimacy, and welcome to guest and family.

If you use candelabra on the table, let us show you how to eliminate hanging fixtures and still not depend entirely on candles when not desired.

Brackets unnecessary except for effect.

With the table amply lighted, the balance of the room can be in shadow and is more interesting this way.

Kitchen—(a) General illumination for entire room by a ceiling fixture.

(b) Pendant directly over sink.

(c) Chain pull socket over hood of range.

Bathroom—No ceiling fixture necessary.

Preference—1. Brackets either side of mirror.

2. Over mirror or medicine cabinet.

Bedrooms—Generally poorest lighted room in the house.

Shall the fixtures match the wall paper?

Let us show you the system adopted by all the leading hotels in the country, using ceiling fixture only and no brackets.

Generally speaking, a light on either side of dresser and a plug at the head of the bed are ample.

Do you like to read in bed?

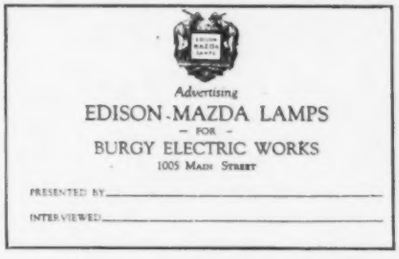
Have you ever seen a good bed lamp?

K. L. Francis, general manager of the Albert Sechrist Manufacturing Company, Denver, Colo., designed this new fixture display room in what was formerly a workroom of the factory at 1717 Logan Street. Attractive in its apointments and complete in its facilities for individual display of each fixture, the display room has proved a valuable feature of the company's policy. A control panel in the right hand picture, near the telephone, gives the one in charge complete control of the lighting of every fixture.

Dealer Uses Boy Salesmen to Sell Mazda Lamps

A combination advertising and lamp sales stunt was successfully conducted recently by the Burgy Electric Works, Vancouver, Wash. Schoolboys were encouraged to work as lamp salesmen after school hours to earn a radio set. No contest was instituted but every boy was given to understand that if he completed the proper amount of work he could earn a set.

On starting to work each boy was instructed in the kinds of lamps to sell for ordinary purposes, and was sent out with a basket of the most commonly used sizes and types, and a price list to which he could refer. In addition he carried a quantity of cards such as the one reproduced herein on which he could report having interviewed a prospect. If the prospect was stocked with lamps and did not want to buy, the boy would ask him to sign the interview card, which counted as a credit toward earning the premium, and at the same time advertised the store. When the customer desired a lamp which the young salesman did not happen to have with him delivery was made later. All sales were for cash, and though this caused the boys some trouble in keeping sufficient change on hand, nevertheless it saved the store from carrying small accounts some of which might have proved to be uncollectable.


Advertising
EDISON MAZDA LAMPS
— FOR —
BURGY ELECTRIC WORKS
1005 Main Street
PRESENTED BY_____
INTERVIEWED_____

Card of introduction given boys to establish their standing as salesmen for the electrical dealer.

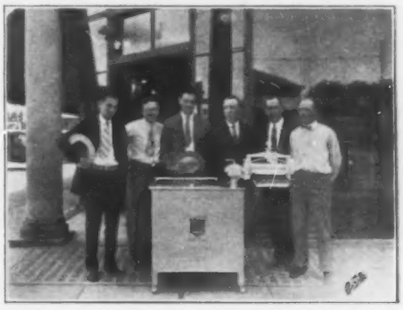
In establishing the basis on which the boys could earn the radio set premium, ten per cent commission was allowed on lamp sales and one cent each was credited for every signed card returned to the office. A total credit of $1.50 was required before the set was won, and this was just about the wholesale cost of the sets offered. This meant that each winner had to sell $15 worth of lamps, or, sell $14 worth and turn in 100 signed interview cards, or some other equivalent combination of sales plus interviews. Some of the boys after earning one set continued long enough to win a second, and those that wanted to stop before the required amount of credit was secured were permitted to pay in cash the balance not yet earned. All told there were fifteen sets earned and a number of others paid for partly in work credits and partly in cash. Besides selling for the store upwards of $200 worth of lamps, the boys advertised the name of the Burgy Electric Works to hundreds of prospective customers in Vancouver through the medium of the interview cards. It will be recognized that this was extremely low cost advertising.

Washer Sales Exceed Quota in Colorado Campaign

For the first time in history, a carload of electric washing machines was shipped into the Grand Valley district of Colorado as the result of a 30-days sales campaign conducted from the headquarters of the Public Service Company of Colorado at Grand Junction during August and September.

In the shipment were 80 Graybar Electric Clothes Washers to be disposed of in the four cities of Grand Junction, Palisades, Fruita and Rifle. When the campaign was over it was found that the sales force had overshot the mark, having placed 104 machines.

The organization which handled the campaign is a new one, the Grand Valley properties having been acquired by the Public Service Company of Colorado on June 1 of this year.



Sales force of the Grand Valley office of the Public Service Company of Colorado. Left to right: Leroy Reigle, office salesman; C. G. Henderson, R. C. Elliott, H. W. Moore, R. C. Young and H. P. Dockstader, new business manager.

Twelve Thousand Attend Display Opening

Southern Colorado Power Company Features Large Merchandising Display in New Quarters

In line with the new merchandising policy of the Byllesby properties, the Southern Colorado Power Company, Pueblo, Colo., recently opened a large new merchandising display room in connection with its new office building at Main and Fourth Streets. With a well arranged program of publicity and advertising the opening of the new offices in the Colorado Building was made the occasion of a visit by 12,000 people, customers of the company in the territory served.

Twelve thousand people attended the opening of the new offices and salesroom.

From the standpoint of acquainting the company's customers with the new facilities to serve them provided in the new building, as well as from a general public relations angle, the opening proved to be unusually successful. The crowd which surged through the new display room containing the merchandising displays was brought in contact with the company's stock and merchandising facilities.

Preparations were made to care for 5,000 visitors. That 12,000 came and registered, many others not registering, was evidence of the interest aroused by the opening and the methods used to bring it to the attention of the public.

Invitations, as reproduced in the accompanying illustrations, were sent to customers in the territory served. Street car patrons were also given invitations to attend the opening. Advertising in each of the city's newspapers invited public attendance.

Recreation hall, where employee meetings, sales meetings and public meetings are held.

Model kitchen built in one corner of the basement.

The salesmen's quarters in the basement provide space for desks and appliances to be sold.

Clever Follow-up Plan

But one of the most adroit features of the plan was the registration card. A card was given each visitor. The card was numbered and a tag bearing the same number was retained by the visitor. A prize drawing was to be conducted upon these numbers, it was announced, and so the cards were in demand.

On the card was written:

To Our Patrons:

We appreciate the honor of your presence at our formal opening. The displays of standard, high class appliances have been arranged for your benefit, so just feel free to ask questions or to request demonstrations. New electrical inventions are greatly simplifying the work in the modern home. We want to serve you by furnishing facts and full details of these conveniences, so please enroll with us to aid in our educational campaign.

Southern Colorado Power Company.

On the bottom of the card was space for name, address and phone numbers. The particular value of these cards is at once apparent. As an indication of interest in electrical appliances and serving as a request from the customer for further information, the way was left open for future circularization on appliances. This work is to be followed up by the merchandising department of the company.

Something of the set-up of the new offices may be gained from the following enthusiastic newspaper account of the opening:

"The main floor of the new offices occupies 6,120 sq.ft. of floor space. Windows open on both Main and Fourth. A large display window fronts Main and five full six-plate glass windows admit light from Fourth. Smaller windows punctuate the remainder of the south side of the offices.

"The front portion of the office, 50 x 30 ft., comprises the display room for all modern electrical appliances. Everything electrical will be found neatly shown in this display. In addition to the display window on Main the large windows on the Fourth Street side give the passerby a view of these modern appliances.

"Back of the display space is the cashier, local accounting department, and contact clerks. All equipment is up to the minute. The woodwork is of walnut. These offices require 1,200 sq.ft. of floor space. The office of the manager, assistant manager, general offices, and general accounting department are found in the rear portion of the building.

"The feature that strikes the patron most is the volume of light that floods the entire office. In addition to the spacious windows there are some 500 electric lights. A string of columns divide the front portion of the space and attached to these are outlets for the attachment of various electrical appliances. Two strings of dome lights, numbering 45 in all, illuminate the display space. In addition to these are various lights on all walls.

Model Kitchen

"Entering the basement the patron finds a model kitchen, employees recreation and convention hall, and display room for heavy duty appliances. In the kitchen, so constructed as to resemble the kitchen of a modern bungalow, is found every known appliance that makes the work of preparing a meal easier.

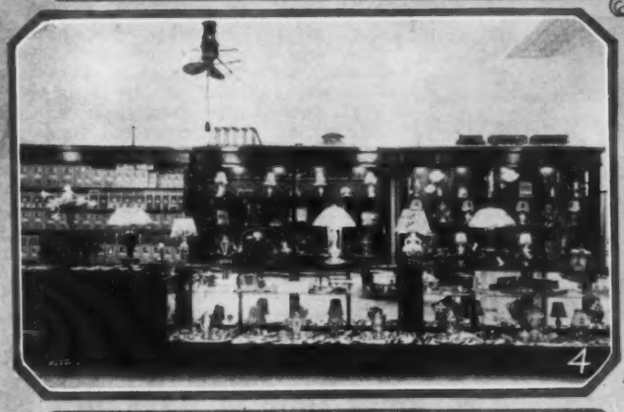
The recreation hall is floored with maple and will offer excellent facilities for dancing. It is well illuminated with eight large lights. The hall will also be used for sales meetings, classes and monthly meetings of various departments. Company officials have long desired such accommodation as this.

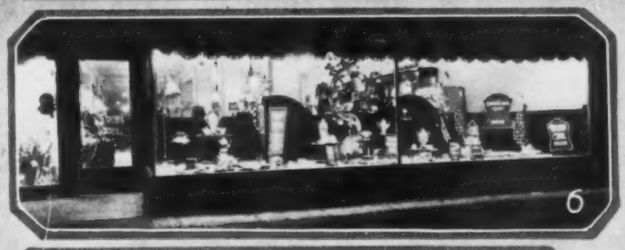
"The formal opening will start at noon Saturday and continue until 10 p.m. There will be souvenirs, refreshments and music. Dancing will be enjoyed in the recreation hall. A large orchestra has been engaged to furnish the music.

"E. F. Stone, assistant general manager, is to be congratulated on the planning of the new office. He has been assisted by J. W. Devereaux, vice-president of H. M. Byllesby & Company, the parent organization of the Southern Colorado Power Company."

You Are Invited to the Formal Opening
of Our New Appliance Sales Department
Corner of Fourth and Main Streets
Saturday, Sept. 11th, from 12 to 10 p. m.
You are cordially invited to attend and bring your family and friends.
There will be a demonstration of all the latest electrical devices for the home. You will be interested in the model kitchen where you will find every electrical help—the kind of kitchen that every woman wants for her own home.
The displays will interest you—you will enjoy the music, the refreshments, and everyone will receive a souvenir of the occasion.
We Hope You Will Accept Our Invitation
Southern Colorado Power Company
We Want All Our Customers to Get Acquainted With Our New Home.
To Our Patron:
GIFT COUPON
THIS IS YOUR SPECIAL INVITATION AS A STREET CAR PATRON
You are cordially invited to attend the formal opening
of the
New Headquarters
and
Appliance Sales Department
of the
Southern Colorado Power Company
Colorado Building
Saturday, September the eleventh
12:30 noon to 10:00 p. m.
Souvenirs Refreshments Music

Advertising used to announce the opening of the Southern Colorado Power Company's new offices and salesroom. The newspaper advertisement, the coupon certificate, the street car rider's invitation and the formal announcement are reproduced above.





IN connection with its new offices the Southern Colorado Power Company, Pueblo, opened a large merchandising display and sales room, which it invited all its customers to visit. (1) A general view of the sales room. (2) The showcases and lamp sales counter along one wall of the display room. (3) At night windows on two sides of the building allow ample display facilities. (4) Looking at the lamp counter and small appliance showcases. (5) The company's electric sign and brilliantly lighted windows point the populace to this attractive store. (6) One of the formal opening's window displays of small appliances. (7) The large windows on the street give a view from outside the building to the well arranged display floor within. This spacious store was first shown to the public at the formal opening and crowded to capacity by the 10,000 visitors who came. Accompanying photographs show other portions of the new offices, salesmen's quarters and recreation hall of the Southern Colorado Power Company.

NEWS OF THE INDUSTRY

San Francisco Manufacturer to Build Plant in St. Louis

The Pacific Electric Manufacturing Company, a Western concern with headquarters and factory in San Francisco, has reversed Horace Greeley's famous mandate and gone East—that is, to the extent of announcing its intention of building a manufacturing plant in St. Louis. The plant, which will be erected in the new industrial district of that city, will cost approximately $175,000 and in the beginning will employ about 150 men.

The company, which manufactures high-tension electrical switching equipment, competes with Eastern manufacturers, and the heavy freight cost of shipping products East was a large factor in the firm's decision to build the new plant.

The Pacific Electric Manufacturing Company has branch offices and agencies in Los Angeles, Denver, Seattle, Dallas, St. Paul, Kansas City, Birmingham, Chicago and New York. Joseph S. Thompson is its president.

New Financing Planned by Two Western Power Companies

New financing planned by the Great Western Power Company of California, San Francisco, and the San Joaquin Light & Power Corporation, Fresno, both Western Power Corporation properties, recently was revealed by application made by those companies to the California Railroad Commission for permission to issue and sell some of their securities.

At about the same time the Western Power Corporation, New York, offered for sale $10,000,000 of its series A 5½ per cent convertible collateral trust gold bonds. Security for the issue of Western Power Corporation bonds consisted of collateral pledged with the National Bank of Commerce, New York, as trustee, of more than a majority, in each case, of the outstanding stock of the Great Western, San Joaquin and Midland companies.

This includes $27,498,700 par value common of Great Western, being all but directors' qualifying shares; $9,900,000 par value of San Joaquin common, being 90 per cent of the stock; $2,000,000 par value San Joaquin prior preferred; $4,475,000 par value San Joaquin preferred, and $999,000 par value Midland common.

Equity following these bonds consists of $9,655,380 par value of preferred stock and 219,000 shares, no par value, common stock of the Western Power Corporation. The bonds will be the only funded debt of the corporation, and the proceeds from their sale will be used to redeem the outstanding $5,823,000 30-year 6½ per cent sinking fund gold debentures and to provide funds for additional investment in the preferred and common stocks of the corporation's subsidiaries.

The bonds are convertible into common stock of the North American Company, which controls the Western Power Corporation.

The San Joaquin Light & Power Corporation filed application with the California Railroad Commission for permission to issue and sell to Western Power Corporation of New York $2,000,000 par value of its prior preferred Series "A" 6 per cent stock at $95 per share, plus accrued dividends; also to issue $1,000,000 par value additional of that stock and to sell it through its own organization at not less than $93 per share; also to issue and sell to Western Power Corporation $4,000,000 par value of common stock at $50 per share, and to issue and sell from time to time $25,000,000 par value of its unifying and refunding mortgage 5 per cent 30-year gold bonds of Series "D" at a price to be fixed by the commission, the proceeds from the sale of such securities to be used to retire $22,725,000 par value of its bonds and to reimburse its treasury for capital expenditures made and to be made,

Great Western Power Company of California applied to the commission for authority to issue and sell to the public $1,000,000 par value of 6 per cent preferred stock at not less than $93 per share and to issue and sell to Western Power Corporation $2,500,000 par value of common stock at $50 per share net; and to apply the proceeds to the reimbursement of its treasury for capital expenditures.

Federal Telegraph Company and Brandes Products Merge

Federal-Brandes, Inc., is the name of a new corporation formed through the merger of the Federal Telegraph Company of California with the Brandes Products Corporation, Newark, N. J. The company controls several big plants for wireless operation and the manufacture of radio equipment and acoustical devices located at Palo Alto, Calif., Newark, N. J., Toronto, Canada, and Slough, England.

The head of the combine is Rudolph Spreckels, who has general management of the financial interests. Ellery W. Stone, for nearly three years president of the Federal Telegraph Company, has been made president of Federal-Brandes, Inc. Other officials are: Frederick Dietrich of Newark, N. J., vice-president in charge of production; M. C. Rypinksi, vice-predsident in charge of patents and development; Augustus Taylor of San Francisco, secretary; Walter H. Dood of New York, assistant secretary; J. E. Godcharles of San Francisco, treasurer, and Frederick Dietrich, assistant treasurer. C. A. Spreckels is chairman of the executive committee. On the board of directors, in addition to the officers named, are Howard Spreckels, Robert Hays Smith and Horace Hill, all of San Francisco.

Headquarters of the new concern will be in San Francisco, with offices in the Hobart Building.

Completion of Melones Dam Is Marked by Dedicatory Ceremonies

Dedicatory ceremonies marking the completion of the dam erected by the South San Joaquin and Oakdale Irrigation Districts 30 miles east of Oakdale in Stanislaus County, Calif., were held Nov. 11.

The dam, built through a co-operative agreement between the farmers of the two irrigation districts and the Pacific Gas and Electric Company, is 185 ft. high. Concurrent with the erection of the dam and as a part of the co-operative agreement, the Pacific Gas and Electric Company is constructing a concrete-lined pressure tunnel from the dam to the site of the power house which is under construction about one mile downstream from the dam. The tunnel and power house are scheduled to be completed early in the spring. The plant will have an installed capacity of 36,000 hp.

In brief, the agreement made between the interested parties provided that the districts should build at Melones a dam capable of storing 112,500 acre-ft. of water and to cost approximately $2,200,000. The Pacific Gas and Electric Company agreed to build a power house costing $2,500,000 and to pay to the districts a total of $5,175,000 in semi-annual installments of $64,687.50, over a period of forty years, or a sufficient sum to pay both the principal and interest on the bonds issued by the farmers.

In addition the power company will turn over for the use of the farmers, without charge, the waters stored for power purposes on the Stanislaus River after it has passed through the power company's plants. This water averaging annually about 35,000 acre-ft. heretofore has been purchased by the districts. Plans already have been announced for additional storage of about 40,000 acre-ft. so that the farmers get without charge an extra 75,000 acre-ft.

Under the agreement the farmers control the river and its flow from March 1 to Nov. 1, and the power company for the remainder of the year.

Among the speakers at the ceremonies were W. E. Creed, president of the Pacific Gas and Electric Company, and John Hancock, attorney for the South San Joaquin Irrigation District.

Motor Prices Reduced by General Electric Company Dec. 1

A reduction in the price of its motors has been announced by the General Electric Company, to be effective Dec. 1.

Stationary motors, in most lines, from 1 to 200 hp. in size, will be reduced approximately 5 per cent. Commonly used types of squirrel-cage induction motors are reduced 10 per cent, bringing the prices of such motors to within about 10 per cent of 1914 price levels. Price reductions affect all direct and alternating current, constant and variable speed, general purpose motors, from 1 to 200 hp.

Improved manufacturing processes, quantity production, and the introduction of labor-saving devices make possible the reduction, according to E. O. Shreve, manager of the company's industrial department at Schenectady, formerly San Francisco district manager.

Coincident with this reduction in prices, the General Electric Company has announced a unified schedule of discounts for different classes of purchasers. The discount for quantity purchased at one time on one firm order has been made uniform on a sliding schedule for all classes of buyers.

Arizona Republicans to Contest Governor Hunt's Election

The Republican state executive committee of Arizona has decided to contest in the courts the apparent election of George W. P. Hunt as governor of that state. A committee has been appointed, headed by Lloyd B. Christy of Phoenix, to conduct a contest and to obtain funds by general call upon the Republicans of the state. It is estimated that $10,000 will be needed.

As matters stand now, Governor Hunt, Democrat, apparently has been elected over his Republican opponent, E. S. Clark, by about 270 votes, although four counties so far have failed to report their returns to the secretary of state, according to latest news dispatches.

In 1917 Governor Hunt contested the election of his opponent as governor. The superior court decided in favor of the Republican candidate but its decision was reversed by the supreme court and Governor Hunt was seated.

Every California County Voted Against Water-Power Act

Final returns from 96 per cent of the precincts of California show that every one of the 58 counties of the state voted against the proposed Water and Power Act at the recent election.

The majority against the measure is 388,356, with the possibiliity that the total may reach 400,000 when all the returns are in. While the third defeat of the proposal was by a smaller vote than in 1922, when the majority against was 353,849, and in 1924, when 431,602 voted against it, the percentage of "No" votes on Nov. 2 was larger than ever, but the majority was held down by the smallness of the poll as compared with that of 1924. Applying the 1926 percentage to a total vote as large as was cast two years ago would give a majority of 483,000, indicating the high disfavor in which the measure is held.

Aside from thinly populated Modoc County, which voted nearly 7 to 1 against the measure, and Alpine County, with a vote of 5 "yes" to 33 "no," the heaviest proportional adverse vote was in Orange County where the ratio was more than 5 to 1. Ventura and San Bernardino voted almost 5 to 1 against the bill, while in Riverside, Monterey, Mendocino, Kings, Napa and Santa Barbara Counties the vote exceeded 4 to 1.

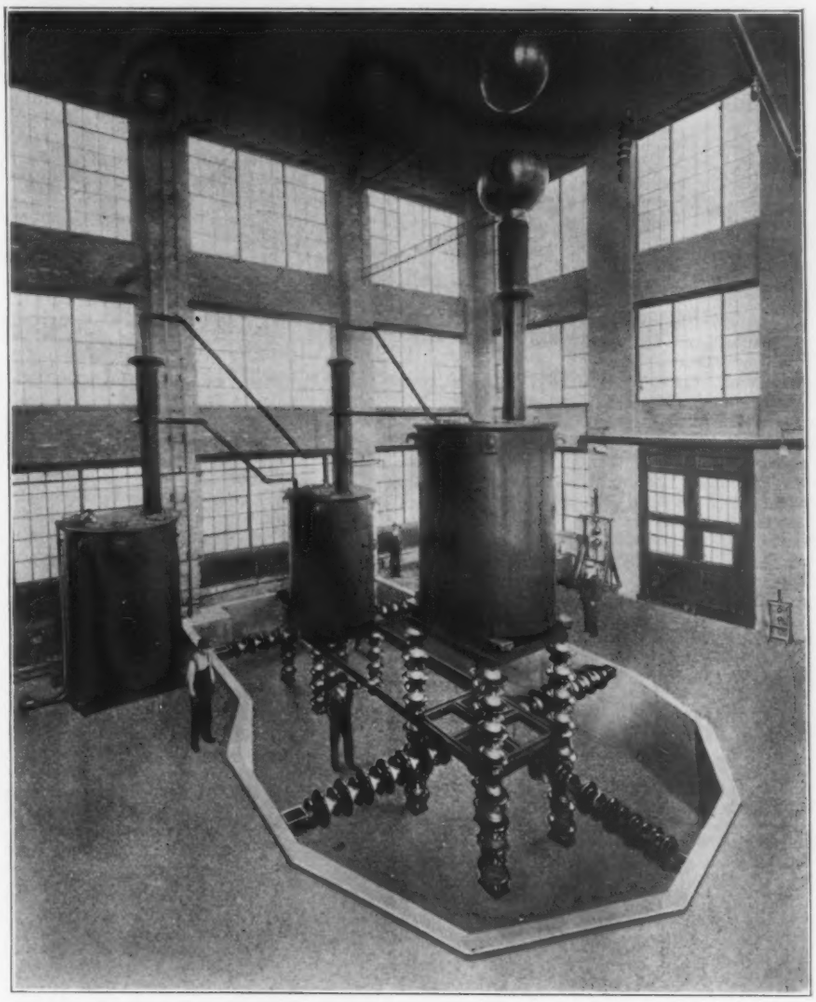
Some of the larger actual majorities against the act were: Los Angeles, 157,151; Alameda, 38,795; San Francisco, 31,818; Orange, 15,083; Santa Clara, 13,973; San Bernardino, 12,863; San Joaquin, 9,908; Sonoma, 8,335; San Diego, 8,221; Fresno, 8,135, and Stanislaus, 5,412. Two years ago the San Francisco "no" majority was 27,000 and that of Los Angeles 195,000.

Hydroelectric Power Plant Planned for Carson, Skamania County, Wash.—W. G. Hufford of Carson, Wash., plans the development of a hydroelectric plant near Carson, Skamania County, with an estimated capacity of 10,000 hp., at an approximate cost of $250,000.

Electric Company Erects 750-kv. Testing Laboratory

Manufacturers of high-tension electrical equipment realize the fact that extensive investigations and tests must be made to insure that the equipment offered for sale will meet the severe conditions imposed by modern interconnection of transmission systems.

The testing laboratory shown in the accompanying photograph has been constructed by the Delta-Star Electric Company, Chicago, is for use of its designing engineers and affords a means of securing the data necessary to make equipment which will have the desired characteristics.



Testing laboratory constructed by the Delta-Star Electric Company of Chicago for its designing engineers. Each of the transformers is of 250-kva. capacity, with primaries of 2,000 volts and secondaries of 250 kv.

Each of the transformers is of 250-kva. capacity and weighs approximately 18 tons. They have primaries of 2,000 volts and secondaries of 250-kv. and are arranged for the cascade or chain connection.

Excitation and control of the transformers are secured by a synchronous motor-generator set, the 2,000-volt winding of the first transformer being connected directly to the alternator. With three transformers in series, there are 750 kva. between the high-tension terminal of the third transformer and ground.

Group Life Insurance Plan Put in Effect by Puget Sound Power Company

Combining life insurance, disability insurance and insured pensions for its employees in one policy, the Puget Sound Power & Light Company, Seattle, has contracted with the Western Union Life Insurance Company, Spokane, for the largest block of life insurance ever written in the state of Washington. The plan, which was a new one to life insurance companies, was evolved after months of negotiation by the officials of the company, and has been approved by the State Insurance Commission, Olympia.

Briefly, the arrangement permits any employee now in the service of the company between the ages of 15 and 69, or any employee entering the service hereafter between 15 and 45, to secure insured protection in the event of death or total and permanent disability, and, at the age of 70, a substantial life annuity, at very favorable premium rates, and with a portion of the premium paid by the company. This portion paid by the company varies with the age of the employee at the time the insurance is taken and increases from 25 per cent at ages 15 to 33 to 75 per cent at age 67 or older.

The amount of coverage under the plan varies with the length of service of the employee. After six months a minimum of $500 can be secured under the contributary payment-of-premium plan, and this amount increases approximately biennially until a maximum of $4,624 is reached at eleven years service. Provision is made for additional insurance of the same kind to be taken by the employee under certain conditions and provided that the employee pay the entire amount of the premium of such insurance as is in addition to the amount allowed him based on his years of service. Premiums are collected by payroll deductions.

Subscription to this plan is not made obligatory. In the official announcement it is stated specifically that no employee will suffer any preference or prejudice in his employment status because he does or does not participate in the plan. Some 3,600 employees are eligible to participate, and if 60 per cent avail themselves of approximately one-half the maximum, as is estimated by insurance officials, the total group policy will amount to $5,400,000.

New 3,000-kva. Unit Added to Minidoka Power Plant

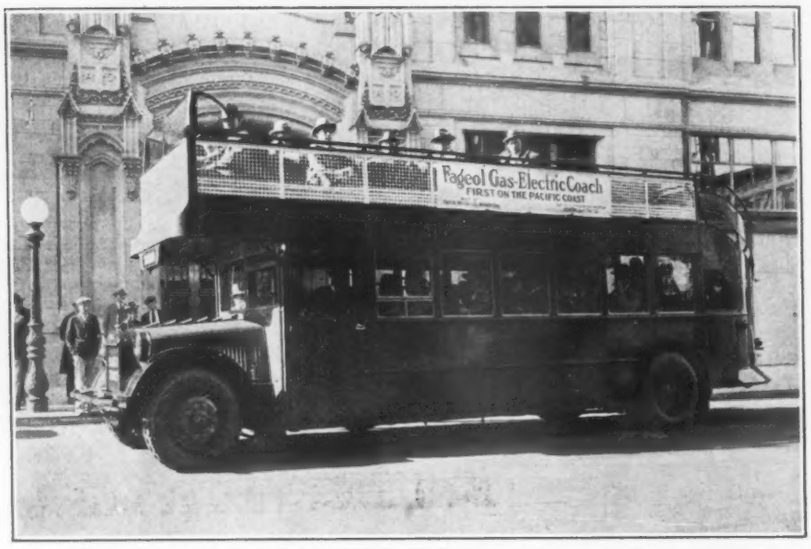
The U. S. Bureau of Reclamation's Minidoka power project near Rupert, Idaho, is being increased in capacity by the addition of a 3,000-kva., vertical Allis-Chalmers generator driven by a 3,500-hp. Newport News turbine. The five original generating units in the plant carry a nameplate rating of 1,600 kw. each. Four 1,000-kva. single-phase transformers are being installed along with the new generating unit.

It is expected that the new machine and its equipment will be ready for operation in June, 1927. Estimated cost of the extension is $230,000.

McGraw-Hill Company Announces Changes in Personnel

The McGraw-Hill Company of California desires to announce the appointment of the following officers and directors: James H. McGraw, chairman of the board; C. T. Hutchinson, president; Edgar Kobak, vice-president. These officials with N. A. Bowers, Pacific Coast editor of Engineering News-Record, and George C. Tenney, managing editor of the Journal of Electricity, will constitute the board of directors.

Mr. Kobak is vice-president and general manager of sales for the McGraw-Hill Publishing Company, with headquarters in New York City, and is also publishing head of the electrical group of McGraw-Hill publications, of which the Journal of Electricity is one.



This gas-electric coach, the first of its kind on the Pacific Coast, was built for the Los Angeles Railway by the Fageol Motors Company, Oakland, Calif., and is proving itself entirely satisfactory in operation.

Permit for Further Development of Skagit Granted Seattle

A preliminary permit for three years has been granted by the Federal Power Commission to the city of Seattle for further development of its power project on Skagit River in the Mt. Baker National Forest, Whatcom County, Wash. The proposed project is designed to utilize the entire head of the river between the Canadian boundary and the city's present power house and dam at Gorge Creek.

The proposed development is to be constructed in three stages, consisting of three dams each with appurtenant power structures. One of the dams will be midway between the tunnel intake at Gorge Creek and Diablo Canyon, another at Diablo Canyon and a third at Ruby Creek. The estimated power capacity of the project is 260,000 hp. It is proposed to transmit the power to Seattle for general public-utility purposes and to develop it as the city requires additional power.

Emeryville Factory Site Bought by Magnavox Company

The Magnavox Company, whose general offices and factory are in Oakland, Calif., has announced that it has purchased a factory site in Emeryville, Calif., and intends erecting buildings upon it in the near future. The property, which takes in a whole block containing very close to four acres, is on Park Avenue north and west of the Emeryville city hall.

Details of the new factory have not been completed, but the company states that the buildings will permit of the adoption of the very latest machinery and methods.

The company manufactures radio apparatus and electric heating devices.

Second Unit of Valmont Plant Has Been Completed

Installation has been completed on the second generating unit of the Valmont plant of the Public Service Company of Colorado. Tests, which have been eminently satisfactory to date, are now in progress and it is expected that the unit will be turned over to the company before the first of the year.

The new machine is a General Electric Company 35,000-kw., nine-stage type. It operates at 1,800 r.p.m., utilizing steam at 700 deg. F. and 375 lb. pressure. Its installation brings the capacity of the plant to 65,000 kw. The work of placing it has been in progress since last February. The total cost is approximately $925,000.

The Valmont plant is of particular interest through the fact that it utilizes pulverized lignite coal for fuel, being the largest plant of this type in existence on an artificial lake.

Telephone and Light Company to Sell its Properties.—California Telephone & Light Company has been authorized by the Railroad Commission to sell its telephone properties located in portions of Sonoma, Mendocino, Napa and Lake Counties, Calif., to Sacramento Valley Telephone Company for the sum of $400,000, of which $300,000 is payable in cash and $100,000 in a note payable in two years, and guaranteed by The Pacific Telephone & Telegraph Company.

Electrical Advertising Program Directors Begin Work

At a recent meeting the board of directors appointed by W. W. Freeman, president of The Society for Electrical Development, to sponsor and direct the electrical advertising cooperative market development program, completed its organization plans in accordance with the specifications laid down in the market development plan.

Reports of subcommittees covering a survey of the potential market, a local sales plan and recommended basis of membership, with such modifications and changes as recommended by the committee, were received and approved and will be embodied in the Plan Book which now is to be prepared in its final and completed form for approval by the committee before printing. As soon as ready, the Plan Book, together with membership application blanks, will be sent to all concerns in the industry with the recommended basis for estimating subscriptions.

For guidance in carrying forward this activity the following resolution was adopted: "The electric sign manufacturers, as organized under the market development plan, purpose to carry on a market development program to demonstrate the value of and popularize electrical advertising, and to supply assistance to local committees in bringing this home definitely to users and prospective users of electrical advertising in all its forms."

Included in the personnel of the board of directors are P. D. Howse, of the Electrical Products Corporation, Los Angeles, who is a member of the commercial group, and George W. Kleiser, of Foster and Kleiser, San Francisco, who is one of the outdoor and display group. The chairman is O. D. Ziegler of the Reynolds Electric Company, Chicago.

Specially Developed Bearings on C. M. & St. P.'s Olympian

The Olympian, the Chicago, Milwaukee & St. Paul Railroad's fast train running from Chicago to Tacoma and Seattle, is to be equipped with bearings manufactured by the Timken Roller Bearing Company, Canton, Ohio, according to announcement. A recent order placed by the railroad company covered bearings for 127 railroad cars, the equipment to be used on nine trains for the Olympian, one each day, each way, and on three trains for the Pioneer Limited, which runs between Chicago and Minneapolis. A large portion of this railroad's system is electrified.

The Timken company has been experimenting with railroad bearings for several years and now has developed a bearing which meets the requirements of railroad service. It is claimed these bearings are peculiarly suitable for this service because of their tapered design which enables them to carry loads and shocks not only from above but also from the side thrust.

Plan for Seattle-Tacoma Highway Lighting Submitted

A plan which provides for illumination of the entire new highway between Seattle and Tacoma, a distance of 24 miles, and known as the Seattle-Tacoma Highline, has been submitted by J. D. Ross, superintendent of the city lighting department of Seattle, to the King County Planning Commission. The proposed work would cost $100,000 for concrete light poles, which would be installed 300 ft. apart. Crossarms from the poles would shed a diffused light over the highway so that machines could extinguish their own lights thus averting accidents from glaring lamps. Engineers estimate that it would cost $5,000 a year for current and $5,000 annually for maintenance, and it is planned to have the state finance the project.

Mr. Ross submitted the project to the planning commission on behalf of the Seattle Light Club, of which he is president, and the Puget Sound Chapter of the Illuminating Engineers of America. The city of Tacoma also is vitally interested in the project and has detailed R. E. Horne, an engineer, to make a complete investigation of the plan.

Four New Power Plants Planned to Be Erected in Japan

Four new power plants are to be constructed in Japan, according to Denkinotomo. Two of them will be built by the Shinetsu Electric Power Company, which recently obtained official permit to erect an 80,000-kw. plant on the Shinanogawa River, to be completed in 1930. The second plant, also of 80,000-kw. capacity, is to be commenced immediately after completion af the first one.

Construction of a 12,000-kw. power plant will be begun by the Kiushu Transmission Company on the Gokase River as soon as the official permit has been secured. The fourth project is that of the Government Iron Foundry which is planning to build a 20,000-kw. generating plant at Yahata in order to electrify its entire works. The cost of construction is estimated at 2,000,000 yen (about $1,000,000).

B. C. Company Plans Second Bridge River Unit

Owing to the development of Vancouver and the Frazer Valley, the British Columbia Electric Railway already is planning to duplicate the first unit of its Bridge River hydroelectric project in order that it may be ready within three years of the opening of the initial 60,000 hp. unit, according to announcement of W. G. Murrin, vice-president.

The preliminary work at Bridge River is nearing completion, and work on the construction of dams, penstocks, powerhouses, and lines will be started early in the new year. To facilitate the movement of supplies to the camps, the company has made three and a half miles of new road and it has re-conditioned five miles of old road from Seaton Lake to the Bridge River site. Full details of the proposed Bridge River development were published in the Oct. 15, 1925, issue of the Journal of Electricity, p. 305.

Mr. Murrin further stated that at the next session of the provincial legislature his company would apply for power to consolidate its several subsidiary companies, thus co-ordinating its various activities in British Columbia, in order to cope more effectively with the growth and development of the country.

Headquarters Opened in Portland by New Jobbing Concern

Announcement of the organization of the A. & F. Supply Company at Portland by Millard Sebern, formerly of the Washington Electric Supply Company of Spokane, marks the opening of a new jobbing concern which will distribute electric supplies in the eleven Western states.

Mr. Sebern was long with the Washington Electric Supply Company, recently sold to the Fobes Supply Company, having begun as a shipping clerk and worked up to the position of manager.

Because of the new A. & F. company specializing in the sale of water tank covers and electric water heaters, the Arthur & Fowler Company of Spokane has determined to open a branch factory in Portland to supply that demand for the new distributing company.

News Briefs

Additional Funds Sought to Complete Arch Dam Experiment.—To complete the experiment on the test arch dam built on Stevenson Creek near Fresno, Calif., Engineering Foundation is seeking funds to raise the dam until it breaks under water pressure. At an expense of $110,000 the dam was raised to a height of 60 ft., and it did not break at that height even when the reservoir was filled so full that some of the water flowed over the top of the dam. (Journal of Electricity, Oct. 15, 1926, p. 310.) To cause the dam to break under pressure of water in the reservoir back of it may necessitate building the dam up 10, 20, 30, or possibly 40 ft. higher, or to a total height of 100 ft., at a further expense of some $30,000.

Oil-Electric Locomotive Used by California Lumber Firm.—A 100-ton oil-electric locomotive is being used by the Red River Lumber Company, Westwood, Calif., to haul logs daily from the woods, a distance of 20 miles. Maximum grades of from 2 to 3 per cent offer no obstacle to the engine, which is a joint product of the American Locomotive, Ingersoll-Rand and General Electric companies.

Lighting Service in Marysville, Wash., Improved.—Improvement of electric light service in Marysville, Wash., and north of that town by a new line is under way by the Puget Sound Light & Power Company, Seattle. The new line will carry 11,000 volts and will cost $30,000.

Reports on Preliminary Work on Aberdeen Project Filed.—Reports on the progress of preliminary work on the Wynooche water and power project, by the city of Aberdeen, Wash., have been filed with Philip H. Dater, district engineer of the U. S. Forest Service, and representative of the Federal Power Commission. A permanent permit for the continuance of construction and location of the dam and power plant there are expected in the near future, city officials state. Permission for the water system has been granted.

Pacific Coast Electrical Association

Responsibility of Commercial Department Stressed at Section Conclave

Increased appreciation of the responsibility of the commercial departments of the electric light and power companies and a more clear-cut understanding of the possibilities of the commercial field were brought forcibly to the attention of the 125 commercial men who attended the general conclave of the Commercial Section of the Pacific Coast Electrical Association held at Santa Cruz, Calif., Nov. 12-13, 1926. A general meeting under the chairmanship of H. K. Griffin, Western States Gas & Electric Company, a feature new to these gatherings, was addressed by three speakers of outstanding importance in the industry on the afternoon of the opening day and helped to make the conclave what was generally conceded to be the finest of its kind held on the Pacific Coast in recent years.

S. Waldo Coleman, president of the Pacific Coast Electrical Association, and president of the Coast Counties Gas & Electric Company, was the first speaker on this program, and in his address on "The Selling Problem of the Electric Light & Power Industry" pointed out that while California has been a national leader in total generation and sale of electric energy, it ranks almost at the bottom of the list in average annual kilowatt-hour sales per domestic consumer. He stated that the national average is 365 kw-hr. per consumer and that in California the average is only about 300 kw-hr. per consumer. The application of mass sales, that is, greater sales to existing consumers, just as the industry has applied mass production in the generation of energy, will quickly correct this situation, Mr. Coleman stated.

In discussing the methods to be employed in achieving greater residential consumption, Mr. Coleman said:

> The subject of increasing the sale of electrical merchandise is receiving probably more attention today by those in the commercial departments of our companies than any other one subject. It is a subject worthy of the metal of the best men in the industry. As in most sales work the methods to be employed cannot reach a permanent standard; in other words, we will never be bale to say finished. But let us not allow any preconceived notions to hamper us from realizing that artificial barriers of trade are not of permanent value, but encourage in every way possible whatever methods of distribution are economically sound. Whether the power companies sell merchandise or not, the public naturally looks to them for guidance in how and where it can best be served with the devices and appliances which it is necessary to have in order that they may obtain the greatest benefit from the use of electric current. This is a call that must be answered by the commercial men of our industry.

A. C. McMicken, general sales manager, Portland Electric Power Company, who traveled from the Northwest to address the meeting, indorsed central station merchandising in no uncertain terms and presented excerpts from letters and telegrams from the commercial manager of practically every utility in the Northwest in support of his stand. He stated that, as a result of unanimity of commercial policies and practices and active merchandising, Northwest electric light and power companies have built load faster than the normal growth and have raised the average consumption well above the national average of 365 kw-hr. per year.

In proof of this statement Mr. McMicken said:

> That this national average can be built profitably to higher levels is proved by the records of the company I represent. For the year 1918 the average consumption of all our residential customers was 245 kw-hr. per annum. For the year 1925 that average had increased to 558 kw-hr. per annum and will probably run approximately 630 kw-hr. for the year 1926. This means that the average residential customer in 1926 will use two and one-half times the number of kilowatt-hours used in 1918, and this change has taken place without any change in rates and is due in part to better illumination standards and in part to the use of current-consuming devices, electric ranges and water heaters. Other companies in the Northwest can present similar figures. This increase is not due to the normal growth of the use of electricity in the home, but to the more or less sustained effort to build load faster than the normal growth and illustrates in a small way what can be accomplished. Commercial men must recognize their responsibility and go into the field and sell more kilowatt-hours. We cannot dodge the issue and we cannot delegate the job.

Ray W. Turnbull, Pacific Coast district manager, Edison Electric Appliance Company, in an extemporaneous and rapid-fire talk, set forth so convincingly the place of good salesmanship and good salesmen in a merchandising set-up that he left no doubt in the minds of his hearers of the necessity for trained salesmanship in load building programs.

"You have to sell these kilowatt hours through the medium of merchandise which can be seen," he told the section. "Therefore you are in the merchandising business." He then set forth the principles upon which good merchandising should be built. An analysis of the situation was of first importance, he pointed out, and then a program to work to. But most important of all was the necessity of having high-grade salesmen to carry out such a program. The carrying out of a sales program could not be turned over to "someone in the bookkeeping department or to the office boy" just because they had been faithful to the company for many years.

"There are four fundamentals to the salesmen's responsibility," he stated, and enumerated them as:

1. Every employee should have a personal sense of responsibility in the company.

2. Give every man a definite responsibility and give him enuogh authority to carry it out. If he has a specific job to do he cannot pass the buck if it is not done.

3. Every man must have a complete knowledge of the goods he is selling.

Part of the Los Angeles contingent which came up from that city on a special train to attend the general conclave of the P.C.E.A. Commercial Section. The gentleman shading his eyes from the sun is W. C. McWhinney, vice-chairman of the section.

Here are most of the one hundred and twenty-five men who attended th lif., Nov. 12-13.
Santa Cruz, Cae general conclave of the Commercial Section, P.C.E.A., that was held in

This is old stuff, but it is still one of the most important factors of selling.

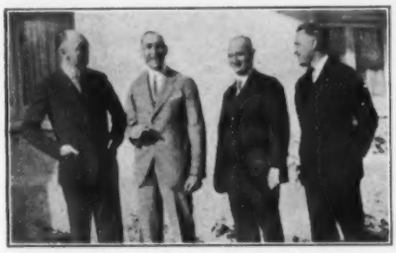
4. Have a workable program, a selling plan, so that your men have some definite aim and goal to work for.

Taking up these four fundamentals in detail Mr. Turnbull stressed the importance of each. Of the first he urged taking the employees into the confidence of the company, as to sales costs, and pointing out that lowered costs should reflect in better compensation. Definite responsibility, he showed, weeded out weak salesmen from an organization and kept them from leaning on and being supported by strong men. Knowledge of the goods he said was all too uncommon, and that often a purchaser of an electric appliance never learned all of its advantages until he had been using it for several months.

In the matter of sales plan he urged especially the value of training for salesmen by thorough education in the workings of the company and equally thorough knowledge of the appliances sold. He urged the cultivation of a "use it" atmosphere in selling, emphasizing the usefulness of the appliance sold.

As to compensation for salesmen Mr. Turnbull was emphatic. "You only get what you pay for," he cried, "and if you can get salesmen who can make more money than the general superintendent, hang on to them. There are not many of them in this world and they are worth it."

Following Mr. Turnbull's talk the meeting was opened for discussion. In this discussion many other angles of the merchandising problem were brought forth and experiences related



The Big Four at the general conclave. Left to right—H. K. Griffin, section chairman, and commercial agent, Western States Gas & Electric Company; A. C. McMicken, sales manager, Portland Electric Power Company; S. Waldo Coleman, president of the association and also of the Coast Counties Gas & Electric Company, and Ray W. Turnbull, Pacific Coast district manager, Edison Electric Appliance Company.

pertaining to particular conditions. It was generally expressed that such information should be brought to the attention of power company executives. J. F. Pollard, manager of the Coast Valleys Gas & Electric Company, in response to this suggestion, declared that executives were hungry for just such information from those who attended section meetings.

Friday and Saturday mornings were devoted to meetings of the various committees of the section along the program outlined by the executive committee. (Journal of Electricity, Oct. 15, 1926, p. 312.) In addition to the committee work previously outlined Chairman Griffith stated that the electric truck committee had been delegated the task of investigating the apparently slow development of electric truck business in California.

One of the important undertakings of the section this year is to outline and perfect a plan of operation which will bring about continuity of effort and permanence of the work of the section. A report prepared by a committee under the direction of Glen D. Smith, Ontario Power Company, was presented to the executive commitee for action and will be acted upon before the next meeting of the section in southern California during the third week in March.

Campaign of Accident Prevention Education Proposed

By M. S. SLAUGHTER, chairman P.C.E.A. Accident Prevention Committee.

Numerous points of importance were discussed at the recent Chicago meeting of the accident prevention committee. A survey of the accident prevention activities of the various utility companies is to be made and a definite plan of organization outlined for an educational campaign to extend the work among those now not taking full advantage of it. To arrive at a definite measure of comparison among various member companies in each division and in the industry as a whole, a statistical subcommittee is proposed.

As a matter of interest and education, all unusual accidents are to be especially investigated by a subcommittee. More than twenty applications for Insull Medal awards were approved.

Dates Set for P.C.E.A. and Northwest Conventions

The 1927 convention of the Pacific Coast Electrical Association will be held at Santa Cruz, Calif., June 14-18, with headquarters at the Casa del Rey. R. L. Cardiff, manager, Coast Counties Gas & Electric Company, has been named general convention chairman.

Salt Lake City has been chosen for the 1927 convention of the Northwest Electric Light and Power Association, and the dates set are June 21-24. J. A. Kahn, president of the Capital Electric Company, has been appointed chairman of the entertainment committee, and P. M. Parry, commercial manager of the Utah Power & Light Company, is chairman of the program committee.

A.I.E.E. News

Six Pacific Coast Men Transferred to Grade of Member.—E. L. Bettannier, Municipal Light & Power Department, Pasadena, Calif.; H. H. Henline, Stanford University, Palo Alto, Calif.; F. O. McMillan, Oregon Agricultural College; H. Michener, Southern California Edison Company; C. E. Mong, The Pacific Telegraph & Telephone Company, Seattle, and A. Morrow, Standard Oil Company, Richmond, Calif., have been transferred to the grade of member according to official announcement.

Associates Elected.—J. W. Dowdy, San Francisco; R. E. Kempf, Berkeley, Calif.; A. Maiman, Fresno, Calif., and S. A. Scanavino, Stockton, Calif., have been elected associate members.

Book Reviews

"Stokers and Furnaces" is the title of a serial report of the Technical National Section, N.E.L.A., recently released from the press. This 50-page booklet covers some of the more important developments of the past year in design, operation and maintenance of stoker equipment and furnaces. Statements by operating and manufacturing companies on automatic and manually controlled combustion systems are included. An article on foreign stoker practice is presented, and numerous improvements in stoker and furnace equipment are reported in the manufacturers' statements. The price to members is 55 cents.

An Investigation of the Fatigue of Metals.—Bulletin No. 152 of the Engineering Experiment Station of the University of Illinois, Urbana, Ill., and listed at 50 cents. A report of the investigation conducted by the experiment station in co-operation with the National Research Council, the Engineering Foundation and several manufacturing concerns. Continuous progress has been made in this study since 1919, and the current report is the seventh of a series, part of which has been published by the University and part by the Engineering Foundation.

Safety Rules for the Operation of Electrical Equipment and Lines.—Handbook of the Bureau of Standards, No. 8. Price 15 cents. Government Printing Office, Washington, D. C. This handbook contains Part 4 of the National Electrical Safety Code. The Code formerly was published in the form of a single volume, but the demand for publications of a handier form has been answered by the publication of the fourth edition of the Code in both the single-volume and the handbook form. Each handbook contains a single part of the Code.

Quantity of Wood Treated and Preservatives Used in the United States in 1925.—By R. K. Shelphenstine, Jr., U. S. Department of Agriculture, Forest Service, Office of Forest Products, Washington, D. C. This is a very comprehensive report and presents a large quantity of information that should be of service to those interested in this subject.

Combined Concrete and Timber in Flexure.—By George Danforth Burr, student in civil engineering, University of Washington. This bulletin presents the results of laboratory tests upon full-size combination concrete and timber structures. Information is presented that should be of interest to structural and design engineers and that should pave the way for further developments in this particularly interesting field. This publication is known as Bulletin No. 37 and may be obtained from the Director of the Engineering Experiment Station, University of Washington, Seattle. Price not quoted.

News of the Electragists

Hear Report of Hill on Article Five and Hutchinson on Wiring Conference

Ben C. Hill, president of the California Association of Electrical Inspectors, and C. T. Hutchinson, president of the McGraw-Hill Company of California, related to a large meeting at the Palace Hotel, San Francisco, Nov. 19, composed of contractors, manufacturers' representatives, jobbers and central station representatives, reports of the recent meetings in the East which they had attended dealing with modern trends in wiring.

Mr. Hill as representative of the electrical industry in the West attended a meeting of the Article Five committee considering the revision of that article in the National Electrical Code. Mr. Hill, supervising inspector, City of Oakland, was sent by the California Electragists and California Electrical Bureau to Atlantic City to bring the Western viewpoint to bear upon the proposed revision.

In his report on the activities of that committee, Mr. Hill stated that more detail in every respect and a number of added sections covering new wiring methods have been incorporated in the revision. Among these the consideration of the use of non-metallic sheathed cable, metal duct, underfloor raceways, etc., were included in this code revision.

Mr. Hill started with a review of the set-up for the proposed code revision. A committee on each article of the code is reviewing that article and submitting proposed changes to the code committees. At this meeting of the Article Five committee were representatives from North Carolina, New Jersey, Illinois and California. A. Penn Denton was chairman of the meeting. W. J. Canada, electrical field secretary for the National Fire Protection Association was responsible for many of the rewritten revisions of the code as suggested in the meeting. Mr. Hill stated that Mr. Canada had written into these revisions more detail than had ever before been incorporated in the code and that the new code when issued would tell contractors **when** and **how** electrical wiring was to be installed. The plan was to make it so complete that all local requirements could be torn up and one could say "Let the Code decide."

In general the rules for non-metallic sheathed cable were drawn tighter, those for armored cable were drawn tighter, and the use of bare conductors in raceways, and of thin metal tubing was referred to the technical committee.

Mr. Hill stated that the Electragists as a group were being felt and that the tendency on the whole will be to keep standards high rather than to let them down in any respect. Any effort to tear them down will be opposed unless it can be proved that present requirements result in waste of material or money. Mr. Hill emphasized the fact that the committee had acted without prejudice and was uninfluenced and that the West was being recognized in these proceedings. He stressed the fact that rubbing shoulders with those of the East was bringing about a closer relationship between the West and the East.

The Aritcle Ten committee meeting after that of Aritcle Five, Mr. Hill stated, was reconsidering the revisions of rotating machinery provisions and proposing wiring tables for motors based on the nameplate reading of the motor.

C. C. Clardy is one of the very active members of the San Diego branch of the California Electragists.

Of Article Five itself several new sections have been proposed and a new title given the section. The new title will be "Wiring Types, Systems, and Methods." The following changes will be made in the titling of sections and the sections added will be found in the revised code:

504 Raceways for surface wiring.
505 Armored cable.
506 Underfloor raceways.
507 Non-metallic sheathed cable.
508 Decorative lighting.
509 Insulation resistance.
510 Auto transformers.
511 Recognized electrical types of interior wiring.
512 Special requirements for use of flexible cords.
513 Bare conductors.
514 Bare grounded wire systems.
515 Tin wall metal tubing.

The last three were referred to the technical committee for their investigation.

Charles T. Hutchinson reported in some detail and with a good deal of humor the joint wiring conference held in New York City in which the National Electric Light Association, the Association of Electragists, International, the National Electrical Manufacturers' Association and the Electrical Supply Jobbers Association had gone into the study of wiring costs. Earl E. Whitehorne of the McGraw-Hill Company, acted as referee.

In reviewing this meeting Mr. Hutchinson gave the gist of the testimony presented by the various groups and ended by reading portions of the very strong brief presented by the Electragists at that meeting. Mr. Hutchinson said that further conferences on this matter were expected in December.

Northwest Inspectors' Standards Committee Active

The work of the Standards Committee of the Northwest Association of Electrical Inspectors, with E. G. S. Pryor, resident engineer, Underwriters' Laboratories, Inc., Seattle, chairman, has been going forward. Recommendations for changes in the National Code will be brought by the committee before the convention of the association in January.

Other members of the committee are: A. A. Tobey, Morrison Electic Company, Portland, sub-chairman; J. J. Agutter, contractor, Seattle; H. S. Jenkins, chief electrical inspector, Bellingham, Wash.; R. E. Thatcher, superintendent of service central district, Puget Sound Power & Light Company, Seattle; H. A. Patton, electrical engineer, Washington Surveying and Rating Bureau, Seattle; T. W. Stevens, munipical power and light department, Seattle; F. D. Weber, electrical engineer, Oregon Insurance Rating Bureau, Portland; F. H. Murphy, illuminating engineer, Portland Electric Power Company, Portland; and L. W. Going, chief electrical inspector, Portland.

About to start something, is Bill Conery who, with Ted White, makes up the Gas & Electric Service Company of Chico, Calif. What Bill is about to start is another electrical installation in the way of a starter.

Canada to Speak at Convention

Word has recently been received by the secretary of the Northwest Association of Electrical Inspectors, F. D. Weber, electrical engineer, Oregon Insurance Rating Bureau, Portland, that W. J. Canada, electrical field secretary, National Fire Protection Association, will be present to address the convention. Other features of the convention program have not yet been worked out to a point where they can be announced.

Meetings

Electrical Heating Association Formed in San Francisco

In order to promote the use of electricity for industrial, commercial and domestic heating, a number of those interested in San Francisco have decided to organize an association to be known as the Electrical Heating Association. A meeting was held Nov. 17 at the States Restaurant, at which the following were present: C. R. Owens, General Electric Company; Arthur Kempston, Apex Manufacturing Company; H. G. Landis, Miracle Heater Company; C. R. Sullivan, Westinghouse Electric & Manufacturing Company; R. Turnbull, Edison Electric Appliance Company; J. L. Farley and C. H. M. Smith, Pacific Gas and Electric Company; J. W. Wrenn, W. J. Walsh, O. F. Anderson, F. W. Davies and D. Larnach, all of the Great Western Power Company; H H. Daley. H. A. Mulvaney, A. Strauch and Richard A. Fisk, all of the Majestic Electric Appliance Company; T. J. Mellon, Wesix Electric Heater Company.

The meeting was an interesting one, and some very good talks were made by Ray Turnbull, Harry Daley, Harry Mulvaney, Arthur Kempston and C. R. Owens. J. L. Farley acted as chairman and C. R. Owens as secretary.

A nominating committee consisting of C. R. Owens, H. A. Mulvaney and J. W. Wrenn was appointed to select officers and committees for the association. The nominating committee met the following day and nominated the following officers and committees:

President—John L. Farley; vice-president—Arthur Kempston; secretary and treasurer—C. R. Owens; executive committee—W. W. Hicks, Harry Daley and D. Larnach; program committee—R. Turnbull, H. E. Sandoval and Floyd E. Crawford, Electric-Steam Radiator Corporation; educational committee—E. A. Wilcox, H. C. Landis, C. R. Sullivan and R. J. Larrabee; rate application—W. J. Walsh, A. Strauch and C. H. M. Smith; publicity committee—W. A. Cyr, Journal of Electricity; Walter Heston, Electrical World.

The president and secretary will be members of all committees.

The nominations were to be submitted to the association for approval at its next meeting, which was set for Dec. 1.

COMING EVENTS

Pacific Coast Electrical Association—

Purchasing and Stores Section Meeting
San Francisco, Dec. 2-3, 1926

Advertising-Publicity Section—
Quarterly Meeting
Edison Building, Los Angeles
Dec. 3, 1926

Northwest Association of Electrical Inspectors—

Annual Convention—Multnomah Hotel,
Portland, Ore..
Jan. 17-18, 1927

Pacific Division, Electrical Supply Jobbers' Association—

Quarterly Meeting—Hotel Del Monte,
Del Monte, Calif.
Jan. 27-29, 1927

Northwest Electric Light and Power Association—

Commercial Section
Multonomah Hotel, Portland, Ore.
Feb. 10-11, 1927.

Station Superintendents of Utah Utility Hold Conference

The annual conference of production and transmission department station superintendents of the Utah Power & Light Company was held at the company's general offices in Salt Lake City Oct. 18-19. The morning session on Oct. 18 was presided over by B. E. Gordon, superintendent of the company's Grace plant. J. A. Hale, chief engineer, and Cooper Anderson, superintendent of production and transmission, made brief introductory talks, after which this session was devoted to reports of various committees appointed at the 1925 conference.

At the ensuing sessions the following papers were presented and discussed:

Acoustic Shock Absorbers for Telephone Sets.....R. C. Day
Education .....
H. T. Plumb of the General Electric Company
Reducing Hazards in Station Bus Structures .....P. F. Ashworth
Essential Details to Successful Station Operation.....A. L. Jones
Fire Prevention and What to Do in Case Fire Breaks Out.....W. J. Hancock
Assistant Chief of Salt Lake City Fire Department.
Type "A" Master Clock and Telechron and System Speed Regulation.....R. W. Davis
System Operation During Past Year.....
.....H. H. Krueger
System Dispatcher.
High Tension and High Attention E. L. Bourne
Observation of Foreign Engineering Work .....A. N. Geyer
Water Measurements.....B. T. Hegwer
Preventive Measures to Combat Flu and Other Contagion.....Dr. J. C. Landenberger
Cutler Development (illustrated by moving pictures).....S. W. Kittleman
Work Being Done on Lifton Inlet Channel (illustrated by moving pictures).....
.....Frank Dusenberry
Production.....R. E. Pierce
The Purpose and Value of Conference.....
.....M. P. Goudy
New Developments in Radio.....H. T. Plumb

Practically all of the papers brought forth extensive discussion, and much benefit was derived by those in attendance as a result of the conference.

A feature of the gathering was a banquet on the evening of Oct. 19, at which A. W. Ivins, of the first presidency of the Mormon Church, gave an interesting talk concerning conditions in Mexico.

Production and transmission department station superintendents of the Utah Power & Light Company taken at their conference held in Salt Lake City Oct. 18-19.

Colorado League Members Visit Valmont Steam Plant

On the invitation of R. G. Gentry, manager public relations department, Public Service Company of Colorado, Denver, members of the Electrical League of Colorado and their families visited the Valmont power plant of the company a short time ago. Those acting as hosts and hostesses for the occasion were Messrs. and Mesdames Clare N. Stannard, Charles A. Semrad, Guy W. Faller, R. G. Gentry, O. A. Weller, H. T. Hughes, F. R. Jamison, O. L. Mackell, Clarence Keeler, F. F. McCammon, A. E. Addie, J. A. Miller, G. B. Buck, F. S. Henderson, John Elftman, E. K. Hartzell, Messrs. J. E. Loiseau and V. L. Board.

Following an inspection tour of the plant, refreshments were served. Dancing concluded an enjoyable and instructive outing.

E.T.A. Donates to San Francisco League's Kiddies' Box

At a recent meeting of the Electric Transportation Association in San Francisco it was decided that the organization donate $25 to the Kiddies' box at the Electrical Development League and that the presentation be made by a committee consisting of K. I. Dazey, Eddie Wood and Walter J. Walsh at the meeting of the Electric Development League on Dec. 13, the Monday before the league's annual Christmas party to the kiddies. In this connection members of the Electric Transportation Association were urged to be present on Monday, Dec. 13, at the Electrical Development League luncheon in the Palace Hotel and were requested to get together and take possession of a table at the meeting.

The future existence of the Electric Transportation Association was discussed, and it was proposed that a meeting be scheduled for January, 1927, to consider this matter. While no date was actually set it was agreed that a meeting would be held during the second or third week of that month to discuss the future activities of the association.

The entertainment at the meeting was in the capable hands of A. J. Anderson.

Personals

S. B. Gregory, Pacific Coast representative of the Arrow Electric Company, with headquarters in San Francisco, visited Los Angeles a short time ago.

William C. Lynch, of the Aluminum Company of America, with headquarters in San Francisco, made a business trip to Los Angeles a short time ago.

H. S. Jones, manager, Robbins & Myers Company, San Francisco, recently left on a trip to the firm's factory in the East.

A. H. Jaeger, sales manager, Leonard Refrigerator Company, Grand Rapids, Mich., has been made secretary of the company in addition to his present position. Mr. Jaeger was for four years manager of the appliance division of the Edison Electric Appliance Company, and early in his career he was branch manager of the Holabird Wholesale Company, Seattle.

Melvin E. Lanning, Denver representative of the Westinghouse Electric & Manufacturing Company, recently returned to that city from Boise, Idaho, where he had been supervising an extensive electric range campaign.

Frank A. Leach, Jr., vice-president and general manager, Pacific Gas and Electric Company, San Francisco, recently paid a visit to Sacramento, Calif., where he conferred with **E. W. Florence,** division manager, and inspected some of the company's properties.

S. V. Walton, formerly manager of the home department, Great Western Power Company, with headquarters in San Francisco, has been made sales engineer of the company's Oakland division, with headquarters in that city.

N. E Curtice, chief engineer of the Southern California Telephone Company, Los Angeles, has resigned to accept a position with the National Telephone Company of Spain. His new work will deal with toll and telegraph engineering.

F. E. Dellinger, overhead electrical engineer, Los Angeles Gas & Electric Corporation, delivered an illustrated address on "The Electric Meter" before a recent meeting of the members of that company's Employees' Association.

T. R. Smith, junior engineer, in charge of hydrography for the U. S. Bureau of Reclamation at American Falls dam, has been transferred to the bureau's Denver office.

L. J. Burke, who has been secretary to **W. H. McGrath,** vice-president of the Puget Sound Power & Light Company, Seattle, has been appointed assistant to the vice-president.

B. B. Stith and **Harry Bray,** of the Western States Gas & Electric Company, Stockton, Calif., attended the recent auditor's convention in Pittsburgh, Pa.

W. D. McElhinney, vice-president in charge of sales for Copeland Products, Inc., Detroit, recently paid a brief visit to San Francisco where he conferred with Listenwalter & Gough, the company's representative in California and Nevada.

Carl B. Luscombe, formerly manager of the western division of the Public Service Company of Colorado with headquarters at Boulder, Colo., now is assistant manager and general superintendent of the Grand Junction Electric & Gas Manufacturing Company and the Grand River Valley Railway Company, properties recently purchased by the Doherty interests. His headquarters are at Grand Junction, Colo. Mr. Luscombe attended Stanford University for two years and was graduated from the electrical engineering department of the University of Missouri in 1912. He became a cadet engineer in the Doherty Training School at Denver and after completing

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the course was sent to St. Joseph, Mo., as an engineer with the Doherty interests there. He left his duties there for war service, becoming a first lieutenant in the engineering corps and serving overseas. Upon his return he went back to St. Joseph. After brief service he was transferred to Cheyenne, Wyo., as manager of the Cheyenne Light, Fuel & Power Company. Two years later he went to Boulder as superintendent of the western division of the Public Service Company of Colorado and assistant to Charles A. Semrad, general manager. Upon the promotion of the latter in September, 1924, to become vice-president and commercial manager of the company, Mr. Luscombe ascended to the vacancy at Boulder.. **Frank Henderson,** formerly local manager at Boulder, has succeeded Mr. Luscombe as division manager at that point.

W. D. Shannon, general superintendent, division of construction and engineering, Stone & Webster, Inc., Seattle, recently gave an illustrated talk on the Baker River hydroelectric plant of the Puget Sound Power & Light Company before the Western Washington Section of the American Society of Civil Engineers.

B. A. Tracy, who has been connected with the El Dorado plant of the Western States Gas & Electric Company, Stockton, Calif., since it was first put into operation, has resigned to take a position with the Northwestern Power & Light Company, Port Angeles, Wash.

D. C. Green, vice-president and general manager of the Utah Power & Light Company, recently returned from an extended business trip to New York and other eastern points.

E. H. Adams, comptroller, B. C. Electric Railway Company, Ltd., Vancouver, recently made a trip to Honolulu.

W. R. Alberger, vice-president of the Key System Transit Company, Oakland, has returned from a trip through the East, during which he attended the convention of the American Electric Railway Association at Cleveland.

Arthur S. Merrill, general sales manager, Appleton Electric Company, with headquarters in Chicago, recently spent a short time in Los Angeles.

C. J. White, Western representative of the Tork Clock Company, returned not long ago to Los Angeles from a trip to the company's factory in New York.

A. E. Wishon, vice-president and general manager, San Joaquin Light & Power Company, was among the guests at a recent meeting of the San Francisco Electrical Development League.

General John Biddle, U.S.A., retired, and chairman of the board of army engineers that reported on San Francisco's Hetch Hetchy project in 1910, recently visited San Francisco and made a tour of the local units of the water supply system under the guidance of **M. M. O'Shaughnessy.**

J. D. Farrell, president, Seattle Lighting Company, has been appointed to the board of regents of the University of Washington.

H. G. Spencer, of the electric distribution department of the Los Angeles Gas & Electric Corporation, recently celebrated his twenty-fourth anniversary as an employee of that company.

R. E. Cunningham, of Farnham & Cunningham, Los Angeles, paid a visit to San Francisco a short while ago.

C. M. Teats, Pacific Coast representative of the Consolidated Lamp & Glass Company, Coraopolis, Pa., recently spent some time in San Francisco en route from the Northwest. Mr. Teats formerly was Los Angeles branch manager for Moe-Bridges Company.

J. H. Waterbury, for six years in the engineering department of the National Lamp Works of the General Electric Company, has joined the organization of the Benjamin Electric Manufacturing Company, Chicago, and will be in charge of its engineering department.

Frank Parish, of the Fobes Supply Company, Seattle, has returned from an extended tour of Alaska.

Frank A. Ketcham, vice-president of the Graybar Electric Company, New York office, recently spent a few days in Seattle. He was making a tour of his company's branches on the Pacific Coast.

H. P. Dockstader, who has been a statistical assistant in the Denver office of the Public Service Company, has been transferred to Grand Junction, Colo., as local new business manager in charge of gas and electric sales for the Grand Junction Electric & Gas Manufacturing Company.

C. V. Snow, formerly with the Electric Appliance Company and later with the Electric Corporation, both of San Francisco, has become manager of the lamp department of the Wholesale Electric Company in that city.

W. S. Etheridge, formerly of the Hamilton Beach Manufacturing Company, Racine, Wis., has been made sales manager of the electrical division of the American Flyer Manufacturing Company of Chicago. Mr. Etheridge was at one time in his career assistant sales manager of the Edison Electric Appliance Company.

Merritt E. Bailey, formerly of Minneapolis, has been made manager of the sales offices of the W. B. Foshay Company recently opened in Denver. **C. H. Burnworth,** formerly of the Lumbermen's Trust Company, Portland, Ore., is in charge of the company's office in that city.

W. N. Beatty, of the legal department of the Utah Power & Light Company, Salt Lake City, attended the convention of the Western States Taxpayers' Association held recently in Los Angeles.

L. M. Cargo, division manager of the Westinghouse Electric & Manufacturing Company, Denver, recently attended the division managers' meeting at St. Louis. Following the meeting he visited the company's plant at East Pittsburgh.

J. D. Davidson, manager of the electrical department, Hendrie & Bolthoff Manufacturing & Supply Company, Denver, has returned from a business trip to Greeley, Colo.

Phillip J. Noerager, who has served the California Railroad Commission for the last thirteen and a half years as assistant engineer, has resigned to enter the insurance field with one of the large life companies. Mr. Noerager was in charge of electric power line inspection from 1913 to 1917, and afterwards was an assistant engineer in the hydraulic division and later in the auto stage and truck division.

Arthur Vieau and **Ernest Granzow,** Crouse-Hinds representatives from Minneapolis, were in Denver recently in the interest of their company.

Walter E. Potter, special representative of the National Lamb Works, with headquarters at Seattle, Wash., was a recent Salt Lake visitor.

B. E. Rowley, of the Edison Electric Appliance Company, Salt Lake City, returned from a business trip in Idaho not long ago.

J. H. Warden, of the El Paso Electric Company, recently returned from Los Angeles where he spent several days on company business.

J. H. Hood, construction manager for Stone & Webster, Inc., Boston, visited El Paso, Texas, not long ago.

Lansing S. Thorne, general superintendent of railways, El Paso Electric Company, attended the recent district convention of Kiwanis Clubs held in Bisbee, Ariz.

L. G. Marshall has been made assistant power and lighting engineer in the sales department of the El Paso Electric Company. Mr. Marshall formerly was in the Boston office of Stone & Webster, Inc.

N. C. Grover, chief hydraulic engineer of the U. S. Geological Survey, was a recent visitor at American Falls dam.

William Watson, works manager, Allis-Chalmers Manufacturing Company, Milwaukee, Wis., a short time ago made an inspection tour through the Northwest and Pacific Coast territories.

H. F. McPhail, electrical engineer in the Denver office of the U. S. Bureau of Reclamation, made a study recently of the proposed pumping site at Shell Rock Point of the bureau's Okanogan project.

C. C. Cragin, general manager of the Salt River Valley Water Users' Association, Phoenix, Ariz., made a trip to Washington, D. C., a short time ago in connection with a proposed contract for the sale of power.

C. C. Hillis, for the past three years president and treasurer of the Electric Appliance Company, San Francisco, has been elected vice-president of Allied Industries, Inc., of San Francisco, Los Angeles, Oakland, Seattle and Portland. Prominent for many years in the electrical industry on the Pacific Coast, Mr. Hillis has been very active in its affairs and has served it in many different capacities. He has been interested particularly in the Pacific Division of the Electrical Supply Jobbers' Association, having served both as chairman and on the board of executives. Mr. Hillis was one of the pioneers in the California Electrical Co-operative Campaign, now the California Electrical Bureau, and

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was formerly a member of its advisory council. Another organization to which Mr. Hillis has devoted much time and attention is the National Electrical Credit Association, of which he has been president twice and on whose board of directors he has served for many years. Aside from his business activities, he is keenly inerested in golf and has won many trophies.

F. R. Ryan, formerly president and manager of the Morgan Electric Light & Power Company, Morgan, Utah, is the new owner of the North Branch Electric Works, North Branch, Mich. Mr. Ryan sold the Morgan plant a year ago.

M. T. Crawford, superintendent of distribution, Puget Sound Power & Light Company, Seattle, recently returned from a business trip which included Chicago, St. Louis and Minneapolis.

Ray S. Quick, of the engineering staff of the Pelton Water Wheel Company, San Francisco, was among those who witnessed the testing of some new gate valves recently installed at the El Dorado plant of the Western States Gas & Electric Company, Stockton, Calif.

Thomas A. Edison recently was awarded a gold telegraph key by the Lackawanna Railroad as the winner in a contest between "old-time" telegraph operators on a special train between Hoboken and New Village, N. J.

J. F. Partridge, engineer for the California Oregon Power Company, conferred not long ago with **H. K. Smith,** hydrographer, Klamath project, U. S. Bureau of Reclamation, in regard to the control of Upper Klamath Lake.

Harry Byrne, president of the North Coast Electric Company, Seattle, is on a business trip East. He is expected home before the first of the year.

E. C. Denning, electrical contracting engineer, has established offices at 821 Third Avenue, Seattle. He will specialize in power and light contracts and maintenance.

Ray Robinson, manager of the Robinson Sales & Service Company, Seattle, recently returned to that city following a business trip to New York City and other eastern centers.

Robert Miller, Denver district manager of the General Electric Company, has returned from an executives' meeting in Schenectady, N. Y.

E. J. Ludeman, formerly chief clerk at Kelso, Wash., for the Puget Sound Power & Light Company, Seattle, has been transferred to the sales department of the company at Chehalis, Wash.

John McCarty, formerly service man at Chehalis, Wash., for the Puget Sound Power & Light Company, Seattle, has been promoted to the position of local agent for the company at Tenino, Wash.

Max Beals, formerly chief clerk at Prosser, Wash., for the Pacific Power & Light Company, Portland, has been transferred to the sales department of the company at Hood River, Ore.

Herbert Spiegelberg, formerly agent at White Bluffs, Wash., for the Pacific Power & Light Company, Portland, has been promoted to the position of chief clerk for the company at Prosser, Wash.

G. F. Fishback of Olympia, Wash., was the winner of the watch offered by **A. W. Leonard,** president, Puget Sound Power & Light Company, Seattle, in the company's recent electric range campaign. Mr. Fishback sold 215 per cent of his quota. **Leslie T. Clawson,** sales agent at Montesano, won the second prize.

Col. H. G. Winsor, personnel officer, and **Henry Worthen,** safety engineer, respectively, of the Puget Sound Power & Light Company, Seattle, recently visited the company's Bellingham offices in connection with the company's insurance and pension plan for its employees.

Lyman Chitty, formerly in the engineering department of the Puget Sound Power & Light Company's southern district, has been transferred to the eastern district's engineering department.

Ralph A. Hopkins, manager central station division, Westinghouse Electric & Manufacturing Company, Los Angeles, presided at a recent meeting of the Electric Club in that city.

D. G. Kendall, one of the directors of Brown & Fengilly, Inc., has been placed in charge of engineering and sales for the company's northern division, with headquarters in San Francisco.

Obituary

Alves Dixon, manager of the Baton Rouge Electric Company, Baton Rouge, La., and prior to that general superintendent of railways for the El Paso Electric Company, died Oct. 30 in El Paso. Mr. Dixon had been connected with the latter company for twenty-one years.

TRADE NOTES

Kelvinator Division of the **Electric Refrigeration Corporation,** 2051 West Fort Street, Detroit, has placed on the market a buffet Kelvinator, which it describes as a man's refrigerator. This new model is an innovation in the field of electric refrigeration inasmuch as it takes electric refrigeration out of the kitchen into the office, den or dining-room, the company announces. This is a cabinet Kelvinator specially designed for entertaining. It has a storage capacity of 4.4 cu.ft. with extra ice cube capacity. It is offered in three exterior finishes, straight grain walnut, figured walnut and mahogany, with statuary bronze hardware. Each model carries a dial lock of the "safe" type. The interior is finished with white porcelain or Armco iron.

The Electric Material Company, 589 Howard Street, San Francisco, and 443½ E. Third Street, Los Angeles, and the **Harrison Sales Company,** Sales Terminal Building, Seattle, have been appointed Pacific Coast representatives of the **Edwin L. Wiegand Company,** 422 First Avenue, Pittsburgh.

Coast Electric Company is the name of a newly formed electrical jobbing concern, which has been established at 952 Folsom Street, San Francisco, by Harry C. Herning and Eugene P. Schaefer, formerly of the Wholesale Electric Company of that city.

The Heine Boiler Company, St. Louis, has published Volume 2, No. 13, of its "Safety Valve" for August, September and October. This number contains a discussion of the Heine VX type boilers.

Ohio Brass Company, Mansfield, Ohio, has announced that its Los Angeles office now is located in Room 508 Subway Terminal Building, 417 South Hill Street.

The Timken Roller Bearing Company, Canton, Ohio, had an attractive exhibit at the National Machine Tool Exposition held at Chicago recently. The exhibit comprised a display of Timken bearings ranging in size from the small washing machine and generator bearing 1 in. in diameter up to the large steel mill bearing 24 in. across, and a miniature model of the Timken steel plant. A feature of the exhibit was the four Timken rollers which were placed on a cone of a Timken bearing and continually revolved around the cone without any visible cause. This effect was produced by four revolving magnets one for each roller, that were concealed beneath the table on which the device was placed. As the magnets revolved, driven by a small electric motor, the rollers were automatically pulled around the cone.

Clapp & La Moree, 314 East Fourth Street, Los Angeles, have announced that they are representing the American Circular Loom Company, 90 West Street, New York, and are handling that company's Red Seal armored cable and flexible conduits and Xduct and Electroduct rigid steel conduit.

The Dover Manufacturing Company, Dover, Ohio, recently has announced new insured No-Burn-Out table percolators and percolator sets. The maker claims they meet every phase of the growing demand for practical daily-use percolators and sets for every home. The percolators come in two models, plain and paneled, each in two sizes, 6-cup and 9-cup. The percolator set includes serving tray, sugar and creamer, and, the manufacturer states, offers a complete superior quality line and a low attractive price range. The Dover insurance policy is packed with each percolator and percolator set.

Looks like Friday afternoon in the little old red schoolhouse when the little girls brought their dollies and spoke "pieces," doesn't it? But it isn't. It's a "kid party," one of the get-together meetings of the Women's Information Committee of the Public Service Company, Denver.

Harvey Hubbell, Inc., Bridgeport, Conn., announces a new line of Hubbell rectangular outlets with Bakelite screwless plates. This new and attractive design for wall outlets has been developed without modifying the standard T-Slot construction, and any form of bladed cap may be used with it. The screwless plate of Bakelite is snapped firmly into position by the pressure of the fingers—no tools are required. When necessary it may be readily removed for the purpose of painting or papering, without disturbing the position of the switch.

The Okonite Company and the **Okonite-Callender Cable Company, Inc.,** Passaic, N. J., have prepared for issuance to the electric light and power industry a booklet on "Tree Wire." The pamphlet tells why tree wire is needed, how it is used and contains numerous excellent photographs of tree-wire installations.

Roach Appleton Manufacturing Company, 3440 North Kimball Avenue, Chicago, has apopinted **Walter S. Sweet,** 312 Omar Street, Los Angeles, to represent its line in southern California. The company announces that it will continue to maintain a liberal and complete warehouse stock of "Raco" boxes and hangers at that address.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, recently has issued Leaflet L 20291 in which it has discussed the Universal Wemco C insulating oil used for all oil-insulated apparatus, including transformers, oil circuit breakers, induction feed regulators and similar equipment, and which does away with the necessity of carrying different kinds of oil. A general discussion, and descriptions in particular on dialectric strength, viscosity, pour test, moisture, chemical reaction, flash and fire points and other features are included in this leaflet. It may be had upon request at any of the district offices of the Westinghouse company or from the publicity department at East Pittsburgh, Pa.

Allied Industries, Inc., 455 Second Street, San Francisco, which represents the Collyer Insulated Wire Company, Pawtucket, R. I., has had prepared for distribution to the salesmen of jobbers handling its line a compact leather sample case showing the Collyer products. Some of the other companies represented by Allied Industries on the Pacific Coast include the Youngstown Sheet & Tube Company, Tubular Woven Fabric Company, Trumbull-Vanderpool Electric Manufacturing Company and General Porcelain Company.

Electric Household Utilities Corporation, 22nd Street and 54tn Avenue, Chicago, recently issued Bulletin No. 2 on its new washing machines, Thor No. 6 and No. 8, and its No. 30 folding ironer, setting forth the advantages of the new models and the details of mechanical construction. The company also has issued attractive broadsides in color describing both devices.

Harry M. Perry, 702 North Main Street, Los Angeles, has issued a pamphlet on "The Belt-Slacker," which, he claims, is a correctly designed and carefully built short slack belt drive. Illustrations are given of types for different positions, and there is much pulley horsepower information and other data of value to the engineer.